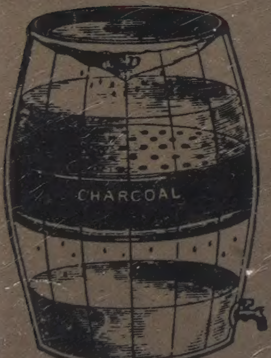
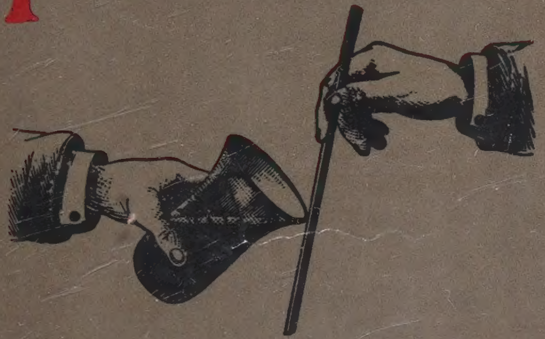
DICK'S
Encyclopedia of
PRACTICAL
Receipts & Processes





or
HOW THEY DID IT
in the
1870's

DICK'S
Encyclopedia of
PRACTICAL
Receipts & Processes

or

HOW THEY DID IT
in the
1870's

How do you make wahoo beer or ginger pop? How do you test gold or silver? How can you remove a ring from a swollen finger? What is the best way to wash a white dog? How can you detect counterfeit money?

For Americana buffs, this re-issue of a century-old encyclopedia with over 6400 receipts and processes is a revealing and unique insight into the do-it-yourself methods of yesteryear. Its purpose was to give "thorough information in plain language applicable to almost every possible industrial and domestic requirement" and, leafing through these pages, it is quite obvious that the purpose was carried out. Americans in the 1870's who had to be mostly self-sufficient in their daily existence must have found this volume indispensable.

There is information on such miscellaneous subjects as how to test mushrooms, how to test the purity of alcohol, how to deodorize putrid whale oil, and how to make candles. There are instructions for dissolving bones for manure, preserving leather, making soap, perfume and fireworks. You can learn how to make imitation French brandy or imitation Bourbon, how to see under water,

(continued on back flap)

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Dick, William Brisbane
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PRACTICAL
RECEIPTS AND PROCESSES.

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or

HOW THEY DID IT IN THE
1870's

BY WILLIAM B. DICK

(This edition prepared by Leicester and Harriet Handsfield)

FUNK & WAGNALLS NEW YORK

Published simultaneously in Canada by Fitzhenry & Whiteside Limited, Toronto.

Manufactured in the United States of America.

L. C. Card 74-12605
ISBN 0-308-10157-X
0-308-10158-8 (paper)

1 2 3 4 5 6 7 8 9 10

SPECIAL NOTICE

This book is intended solely as an historical record and does not represent an endorsement of any recipe, formula, process or other textual material printed herein, nor do the preparers or publishers vouch for any claims made within this book.

PREFACE.

The original design of the compiler of this work was to prepare a collection of popular and domestic receipts, to contain only those whose practical utility had been established, either by actual trial or by the guaranty of undoubted authorities, thus excluding the mass of untried, and, consequently, unreliable information to be found in Receipt Books, compiled with a view to quantity rather than quality. As the work progressed, it was found, in many cases, no easy matter to draw a line between the simple or practical and the artistic or scientific. To meet this difficulty, it was determined to enlarge its scope, increasing the usefulness of the former by the additional light of scientific research, and rendering the latter easy of application by reducing the formulæ and technicalities of scientific writers to plain language, so as to be understood by the uninitiated. To carry out this idea intelligibly, the plan has been adopted of classifying the various subjects treated of in the Encyclopedia, so that each should be presented in a compact form of completeness unattainable by any other method; omitting only, in order to save repetition, such information as could be found in connection with some other subject in another part of the work, but easily reached by the introduction of reference numbers, or by the aid of the Index.

The result of this change of scheme in the preparation of the Encyclopedia is twofold: first, an amount of information on popular and household matters rarely, it is believed, to be found in one volume; secondly, a condensed digest of all the practical information, bearing on the various branches of the industrial arts, that is contained in the best scientific works of modern times, many of which are costly and technical in style, and some of them rarely to be found in this country.

This has necessarily involved an almost incredible amount of patient and persistent labor, rendered unavoidable in order to separate and extract the practical matter from theoretical propositions and speculative deductions, of great value to the expert, but entirely beyond the scope of a popular work; this will be fully corroborated by the annexed list of authorities, which have been quoted or consulted in the preparation of the Encyclopedia. In accomplishing this the compiler has been assisted by a gentleman whose knowledge of languages, and other attainments, have aided him materially in his undertaking.

The various processes and formulæ connected with the Practical Arts form, therefore, a distinguishing feature of the work, of the highest utility both in the laboratory and the workshop. They are further explained, where it has been deemed necessary, with neatly executed illustrations and diagrams, thus giving the inexperienced a clear insight into many of those scientific operations usually supposed to be attainable only by persons trained and educated for the purpose.

The Receipts containing information more especially applicable to domestic matters and the requirements of every-day life, deserve more than a passing notice, as no pains have been spared to make them comprehensive, thorough, and clearly understood; showing not only what must be done, but how to do it, in order to attain any desired result; giving the materials used, their proper proportions, and how to prepare, mix and apply them; introducing also, wherever advisable or necessary, reliable tests for the purity, strength, etc., of the substances brought into requisition. This principle of testing is a noticeable feature throughout the Encyclopedia.

In the Medical department, each recipe or formula is adopted for its efficacy only, without reference to any particular School of Medicine. Some of them are published for the first time in this work, being obtained from the private memoranda of a distinguished physician, and other similar sources.

With the exception of general, but thorough, directions for Curing, Preserving, Pickling and Canning, Culinary receipts have been avoided, as they may be found in any reliable Cookery Book; the design of this work being to afford only such information as is not otherwise easily attainable.

The Tables of Weights and Measures, and their comparative values, are by a competent mathematician, and founded on official or other well-established data. They include also a careful selection of general statistical information from authentic sources.

The last 24 pages consist of Miscellaneous Receipts, which would not readily admit of classification; including, also, a few additional receipts obtained too late to take their place in the part of the book to which they properly belong. These will always be found by consulting the Index, a course which will insure the finding of all the information connected with the subject desired.

Condensation has been resorted to throughout the work, as far as possible, and repetition greatly avoided by the use of reference numbers, which are introduced wherever it has been found necessary to refer the reader for further information contained in some paragraph in another part of the book.

A carefully prepared Index is appended, in as condensed a form as perspicuity will allow. A glance at the directions given at the commencement of the Index will materially aid in finding the article or paragraph sought for.

In submitting to the public this contribution to the popular resources of general information and practical knowledge, the compiler begs to offer his apologies for any errors or omissions that may occur in it; reserving for future editions such corrections and additions as circumstances may suggest, or the march of improvement demand. By no means assuming the impossible attribute of perfection for this work, he believes that its contents will at least warrant his claiming for the Encyclopedia a marked superiority over other existing works of a similar nature.

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Encyclopedia of
PRACTICAL
RECEIPTS AND PROCESSES.

or

HOW THEY DID IT IN THE
1870's

DICK'S ENCYCLOPEDIA
OF
PRACTICAL RECEIPTS AND PROCESSES.

Manipulations. Under this heading will be found a brief description of the various methods of chemical manipulation, constantly employed in this work. This is deemed especially necessary, as many, if not all, of the processes described, depend greatly on careful and skillful manipulation in the preparation as well as in the combination of the necessary ingredients. *(See No. 3830.)*

2. **Annealing.** The process by which glass is rendered less frangible, and metals, which have become brittle, again rendered tough and malleable. *Glass* vessels, and other articles of glass, are annealed by being placed in an oven or apartment near the furnaces at which they are formed, called the *"leer,"* where they are allowed to cool slowly, the process being prolonged according to their bulk. *Steel, iron, and other metals,* are annealed by heating them and allowing them to cool slowly on the hearth of the furnace, or any other suitable place, unexposed to the cold.

3. **Bath.** In cases where an equable heat has to be sustained at, or not to exceed, a certain fixed degree, it is evident that an open fire or flame would be too variable for the purpose. To obviate this difficulty, the vessel to be heated is immersed or imbedded, to a convenient depth, in another vessel containing water, oil, saline solution, sand, metal, etc., as circumstances require, to which the heat is applied and whose temperature can be regulated, if necessary, by the use of a thermometer. Steam is also applied to this purpose; but, of course, requires special apparatus. The baths most commonly used are the water bath and the sand bath.

4. **Sand Bath.** An iron or copper vessel should be employed for this purpose. Sufficient sea or river sand, previously washed clean and dried, must be put in to cover the bottom completely. The vessel to be acted on is then introduced, and the intervening space around it filled up to the desired height with sand, and the whole placed over a furnace. The object of the sand is to cut off direct communication with the fire and produce a gradual and equable heat.

5. **Water Bath, or Bain-Marie.** This arrangement is used where the heat required is not over 212° Fah., and consists of one vessel within another, secured so that they cannot come in contact at any point below the level of the water which has been introduced to fill up the space between them. A double glue-pot is a water bath.

As the temperature of water cannot be increased, in an open vessel, above its boiling point, 212°, a vessel immersed in it can never be heated above that point; and, by keeping the water boiling, this degree can be steadily sustained. Where other degrees of heat are requisite, the following table, showing the boiling points of different substances and saturated solutions, will serve as a guide. A still higher degree of heat may be reached by using, with appropriate vessels, metals whose melting point is known. *(See Index for Melting Point of Metals.)*

6. **Table exhibiting in degrees of Fahrenheit the Boiling Heat of different liquids.**

Ether	96°
do sp. grav.: .7365 at 48°	100
Carburet of Sulphur	113
Alcohol, sp. gr. .813	173½
Nitric Acid, sp. gr. 1.42	247
Water	212
Ammonia	140
Muriatic Acid, sp. gr. 1.094	232
Rectified Petroleum	306
Oil of Turpentine	316
Sulphuric Acid, sp. gr. 1.848	600
do do do 1.810	473
do do do 1.780	435
do do do 1.700	374
do do do 1.650	350
do do do 1.520	290
do do do 1.408	260
do do do 1.300	240
Phosphorus	554
Linseed Oil	640
Whale Oil	630
Mercury	662

7. Table showing the Boiling Heat of various Saturated Solutions.

Saturated solution of

Muriate of Lime	285°
Acetate of Soda	256
Nitrate of Soda	246
Rochelle Salt	240
Nitre	238
Muriate of Ammonia	236
Tartrate of Potash	234
Sea Salt	224⅓
Muriate of Soda	224
Sulphate of Magnesia	222
Borax	222
Phosphate of Soda	222
Carbonate of Soda	220
Alum	220
Chlorate of Potash	218
Sulphate of Copper	216
Acetate of Lead	215⅔
Glauber Salt	213⅓

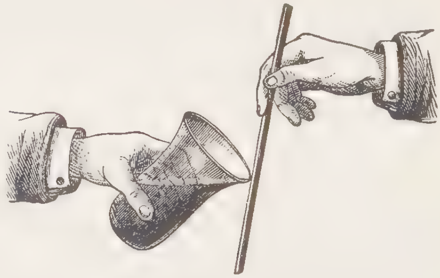
8. Concentration. The volatilization or evaporation of part of a liquid in order to increase the strength of the remainder. The operation can only be performed on solutions of substances of greater fixity than the menstrua or liquids in which they are dissolved. Many of the liquid acids, solutions of the alkalis, etc., are concentrated by distilling off their water.

9. Crystallization. Crystals are symmetrical forms assumed by certain bodies in solidifying from a liquid or gaseous state: and as the same substances, under similar circumstances, always assume the same crystalline shape, their crystals afford a means of distinguishing substances otherwise similar in appearance; as for instance oxalic acid and Epsom salts. Sulphur, anhydrous salts, lead, tin, and other fusible substances which are unalterable by heat are crystallized by *fusion*. They are to be melted at the lowest possible temperature, and allowed to cool very gradually. As soon as a crust forms on the surface (which then becomes furrowed) it must be pierced with a rod, and the fluid portion decanted, and the crystals will be found coating the interior of the vessel. Volatile solids, such as iodine, camphor, etc., when heated so as to produce *Sublimation* (*see No.* 30), yield vapors which, in cooling, take the form of crystals.

Soluble substances are crystallized by the evaporation of a saturated solution of the substance. The solution should be made and, if necessary, clarified and filtered at boiling point, in which state more of the substance is held in solution than when cool; this excess is deposited in crystalline form as the solution cools or evaporates. The crystals thus obtained are strained from the remaining liquid, or *mother water*, and dried.

If strings be suspended in the hot solution, crystals will form upon them during cooling or evaporation; in this manner rock-candy, blue vitriol (sulphate of copper), alum, etc., are crystallized. Crystallization is also sometimes the result of chemical reaction; silver, for instance, precipitated from its solutions by zinc, forms a crystalline deposit.

10. Decantation. The operation of pouring off the clear portion of a liquid from its sediment. This is performed either by gently inclining the vessel, or by means of a syphon. When a liquid is set aside to settle for future decantation by the first method, it is best to use a bell shaped vessel, or one provided with a lip, for convenience in pouring; as in decanting from a full vessel whose side is straight, the liquid is very apt to flow down the outside of the vessel. This can, however, be obviated by holding a glass rod or stick, previously wetted in the liquid, nearly upright, with one end resting in or suspended over the receptacle into which the liquid is to be decanted; the liquid is poured gently down the upper side of the stick, keeping the rim of the vessel in contact with it. The liquid will be more strongly attracted by the wet stick, than by the dry surface of the outside of the vessel. (*See illustration.*)



If this method of decanting is inconvenient, or, from the nature of the vessel, impossible, a syphon must be used. This is a tube of glass or metal, bent at an angle of about 30°, with one leg or end longer than the other. A piece of india-rubber tubing makes an excellent and easily adjusted syphon for decanting liquids which will not affect that material. The syphon must be first filled and then the shorter leg inserted in the liquid, care being taken to keep its extremity always below the surface, and the liquid will flow continuously out of the longer leg as long as there is any left in the vessel. For decanting caustic liquids, acids, &c., syphons of different kinds are provided, constructed especially for the purpose.

11. Deflagration. The sudden combustion of any substance, for the purpose of producing some change in its composition, by the joint action of heat and oxygen. The process is commonly performed by projecting into a red hot crucible, in small portions at a time, a mixture of about equal parts of nitre and of the body to be oxidized.

12. Desiccation. The evaporation or drying off of the aqueous portion of solid bodies. Plants and chemical preparations are deprived of their humidity by exposure to the sun, a current of dry air, an atmosphere rendered artificially dry by sulphuric acid, or by the direct application of heat by means of a water-bath, a sand-bath, or a common fire. Planks and timber are now seasoned, on the large scale, in this way, by which a condition may be attained in 2 or 3 days, which, on the old system, took as many years to produce.

13. Distillation. Distillation consists in vaporizing a liquid in one vessel, and conducting the vapor into another vessel, where it is condensed and collected. The process is used for separating a liquid from solid substances with which it may be mixed; for impregnating a liquid with the volatile principles of plants, as in the preparation of Eau de Cologne and other aromatic spirits, and for separating a more volatile liquid from one less so, as alcohol from water.

For example, as alcohol is transformed into vapor at the temperature of 176°, while water remains, at this temperature, in a liquid state, it is only necessary to heat the mixed liquids to 176°, when the alcohol rises in vapor, and the water is left behind. The vessel in which the liquids are heated is closed by an air-tight cover, and from this cover a pipe is led and coiled through a cask of cold water; as the alcoholic vapor enters this cold pipe it is condensed to the liquid form. This process of evaporating and condensing a liquid is called distillation; the apparatus is called a still or retort, and the coiled pipe is the "worm of the still," or the condenser.

On the small scale distillation is performed in the simplest way by means of the common glass retort (*a,*) and the receiver (*b,*) as in Fig. 1. The retort may be either simple, as in Fig. 2, or tubulated as in Fig. 1, and sometimes the receiver has a tubulure to allow the escape of gas or expanded air, as in Fig. 3. The great advantages of the glass retort are that it admits of constant observation of the materials within, that it is acted upon or injured by but few substances, and may be cleaned generally with facility. Its great disadvantage is its brittleness.

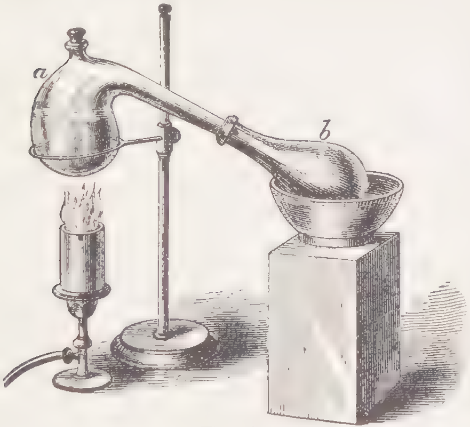


Fig. 1.

The tubulated retort is more liable to crack than the plain one, on account of the necessarily greater thickness of the glass in the neighborhood of the tubulature; nevertheless it is very convenient on account of the facility which it offers for the introduction of the materials.

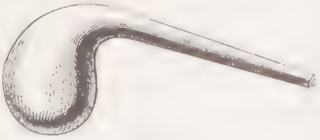


Fig. 2.

When the common glass retort and receiver are used for the distillation of liquids, care should be taken not to apply the luting until the atmospheric air is expelled (*see Lute*), unless the receiver has a tubulure for its escape. The operator should aim at keeping the body of the retort hot, and the neck and receiver cool. A hood of pasteboard will facilitate the former; and the latter will be accomplished by keeping the neck and receiver wrapped in wet cloths, on which a stream of cold water is kept running. This may be conveniently done by means of a syphon, made by dipping one end of a strip of cotton in a vessel of water, and allowing the other end to hang down upon the cloths, bound loosely around the receiver and the neck of the retort. Retorts are heated in a water or sand bath, placed over the naked fire, or they may be held by a circle of metal, in which case the retort may be heated by the argand gas flame, as in Fig. 1, or by live coals. Where it is to be subjected to a heat sufficient to soften the glass, the bulb may be previously coated with a mixture of clay and sand, and dried. *(See Nos.* 1695 *and following.)*

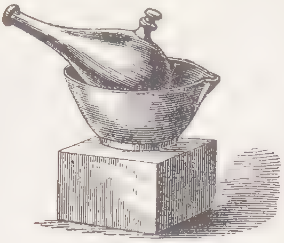


Fig. 3

Even on the small scale it is sometimes necessary to employ distillatory apparatus constructed of other materials besides glass.

The still in general use (*see page* 12) may be considered as composed of three or four parts:

I. The cucurbit or body of the still, A. This portion of the apparatus receives the direct action of the fire, and contains the liquid to be distilled when the process is to be conducted by a naked fire. It is in the form of a truncated reversed cone, A, mounted on a rounded portion, *a a,* which rests on the furnace, X X, and terminated at the top by a collar of somewhat smaller diameter than the lower part.

C is a hole by which the liquid is introduced into the body of the apparatus; *d d* are the handles.

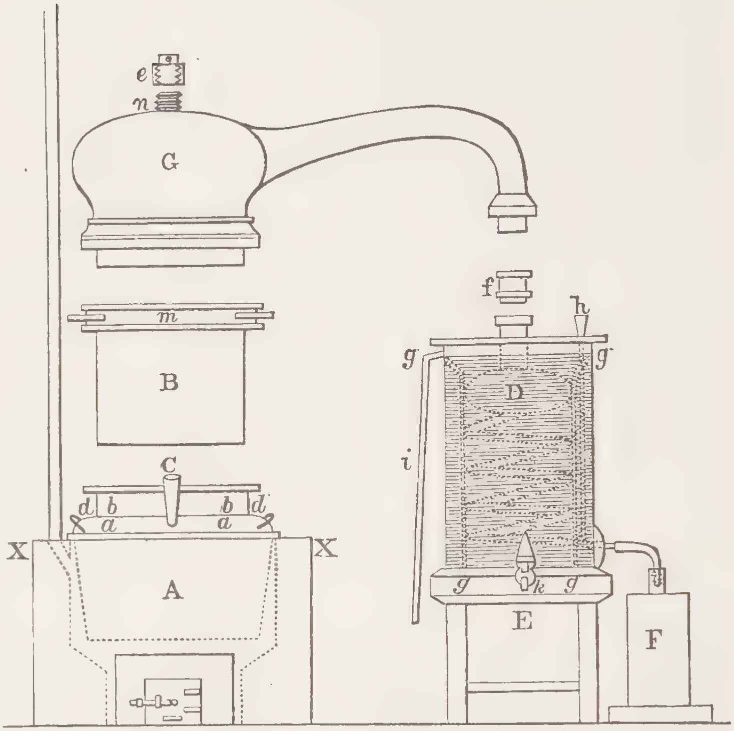
II. The water-bath, B, a cylindrical vessel of tin or tinned copper, which is placed in the cucurbit, A, closing it lightly by means of the collar, *m,* which rests on the collar, *b b.* This vessel is used only when the mixture to be distilled is not exposed to the direct heat of the fire; in this case the cucurbit, A, fulfills the office of a water-bath, and the vessel, B, takes the place of the cucurbit.

When, instead of distilling by the naked fire, the water-bath is employed, water only is put into the cucurbit, in which the vessel, B, is placed containing the liquid to be distilled.

III. The head of the capital, G. This part may be placed either on the cucurbit, when distilling by naked fire, or on the vessel, B, if used, care having been taken to make both openings of the same size; it is very nearly the shape of the upper part of a retort, and is furnished with a large pipe by which the vapor is to be carried off to the worm or cooler.

n. A hole which, during the operation, is kept closed by a screw top, *e,* and its use is to introduce fresh liquid into the cucurbit without having to disconnect the apparatus.

IV. The cooler or worm, D. This is a long tin pipe, bent in the form of a screw, and enclosed in a copper or wooden vessel full of



cold water. The upper part of the pipe, which is often enlarged in a globular form, receives from the beak of the capital the vapors arising from the cucurbit; the lower portion is open below, so that the condensed liquid flows into a vessel placed underneath.

All the joints of the apparatus are to be luted with bands of paper soaked in paste; the joint of the cucurbit, when used as a water-bath, must not be tight, in order to allow of the escape of the steam from the boiling water. *(See Lute.)*

g g. Tin rests for supporting and fixing the worm in the vessel.

h. A vertical pipe fixed to the side of the vessel, open at both ends and terminated at the top by a funnel.

This pipe serves to renew the water in the cooler; cold water is poured in at the top which flows to the bottom of the vessel, and being of a lower specific gravity than the hot water, forces it out at the escape pipe, *i*.

k. A tap, by which all the water in the worm tub can be discharged.

f. A connecting pipe inserted between the beak of the capital and the collar of the still is of precisely the same height as the collar, *m*, of the cucurbit, B, and is only used in distilling by the water-bath; when a naked fire is used this pipe is unnecessary, as the beak will reach down to the collar of the still without it.

In distilling perfumes and cordials, the object is to extract or separate the odorous and aromatic principle from the roots, flowers, seed, or spices used to impart the characteristic odor and taste to the liquor, and it is usual to macerate such ingredients in strong alcohol several days before distillation. Great care should be taken that *the heat should, in all cases, be as gentle and uniform as possible.* Remember that accidents may be effectually prevented by distilling spirits in a water-bath, which, if sufficiently large, will perform the operation with all the dispatch requisite for the most extensive business.

14. **Elutriation.** In chemistry, the operation of washing insoluble powders with water, to separate them from foreign matter, or the coarser portion. It is usually performed by grinding or triturating the mass with a little water, until reduced to a very fine powder, and this paste is suddenly diffused through a large quantity of water in a deep vessel, from which, after the subsidence of the grosser portion, the liquid is poured into another vessel, and allowed to deposit the fine powder it still holds in suspension. When this has taken place, the clear supernatant liquor is decanted, and the sediment drained and dried. The coarse sediment deposited in the first vessel is now submitted to a fresh grinding and diffusion through water, and the entire operation is repeated, until the whole of the pulverizable portion is washed over. The proper length of time for the liquid to remain in the first vessel, depends solely on the density of the powder, and the degree of fineness required in the product; heavy powders subsiding almost immediately, while light ones often take several minutes to deposit their coarser portion. Sometimes three or more vessels are employed, and the muddy liquor, after remaining a short time in the first, is poured into the next one, and this, in a short time longer, into the third, and so on, until the last vessel is filled, by which means, powders of different degrees of fineness are obtained; that deposited in the last vessel being in the minutest state of division.

15. **Evaporation.** The conversion of a fluid into vapor by means of heat, diminished atmospheric pressure, or exposure to a dry atmosphere. The process of evaporation is resorted to;—1. For the vapor as a source of heat or power, as in steam boilers, &c.;—2. To separate volatile fluids from other bodies which are either fixed or less volatile;—3. To recover solid bodies from their solutions;—4. To concentrate or strengthen a solution by expelling a portion of the liquid;—5. To purify liquids by expelling any volatile matters which they may contain. As evaporation is, under ordinary circumstances, confined to the surface of the liquid, wide shallow vessels are the best for the purpose; the pro-

cess is greatly facilitated by exposing the surface to a current of dry air, especially if the air be heated. On a small scale, shallow capsules of glass, wedgwood ware, porcelain or metal, are commonly employed, and are exposed to heat by placing them over a lamp, open fire, or in a water or sand-bath. (*See No.* 44.)

16. Fermentation. Chemists distinguish fermentation into five kinds, viz:

The *saccharine fermentation,* by which starch and gum are converted into *sugar.*

The *alcoholic* or *vinous fermentation,* by which sugar is converted into *alcohol.*

The *viscous* or *mucilaginous fermentation,* which converts sugar into *slime* or *mucilage,* instead of alcohol.

The *acetous fermentation,* by which alcohol is converted into *vinegar.*

The *putrid fermentation,* or *putrefaction,* which is exhibited in its most marked form in the putrefaction of animal substances.

17. Filtration. The word *filtration* is absolutely synonymous with *straining;* but, in the language of the laboratory, the former is usually applied to the operation of rendering liquids transparent, or nearly so, by passing them through *fine* media, as filtering paper, for instance; the latter to the mere separation of the grosser portion, by running them through *coarse* media, as flannel, horsehair cloth, etc., through which they flow with considerable rapidity. *Filtration* is distinguished from *clarification,* by the former removing the solid matter, or cause of opacity or foulness, by mere mechanical means, whereas the latter consists in the clearing of a liquid by depuration, or the subsidence of the suspended substances or fæces, arising from their gravity being naturally greater than the fluid with which they are mixed, or being rendered so by heat or the addition of some foreign substance. (*See Fining.*)

The apparatus, vessels, or media, employed for filtration, are called *filters,* and are commonly distinguished from *strainers* by the superior fineness of their pores, as above noticed.

Both strainers and filters act on the same principles as the common sieve on powders; they all, in like manner, retain or hold back the coarser matter, but permit the liquid or smaller and more attenuated particles to pass through. The term *medium* has been applied to the substance through the pores of which the liquid percolates.

The forms of filters, and the substances of which they are composed, are various, and depend upon the nature of the liquids for which they are intended. On the small scale, funnels of tin, zinc, copper, wedgwood ware, earthenware, glass, or porcelain, are commonly employed as the containing vessels. The filtering medium may be any substance of a sufficiently spongy or porous nature to allow of the free percolation of the liquid, and whose pores are, at the same time, sufficiently fine to render it limpid or transparent. Unsized paper, flannel, linen, muslin, cotton-wood, felt, sand, coarsely-powdered charcoal, porous stone or earthenware, and numerous other substances of a similar kind are employed for this purpose.

Filters of unsized paper are well suited for all liquids that are not of a corrosive or viscid nature, and are universally employed for filtering small quantities of liquids in the laboratory. A piece of the paper is taken, of a size proportionate to the quantity of the substance to be filtered, and is first doubled from corner to corner into a triangle (*see Fig.* 1, *below*), which is again doubled into a smaller triangle, and the angular portion of the margin being rounded off with a pair of scissors, constitutes a paper cone, which is placed on a funnel and nearly filled with the liquid. A piece of paper so cut, when laid flat upon a table, should be nearly circular. Another method of forming a paper filter, preferred by some persons, is to double the paper once, as above described, and then to fold it in a similar way to a fan, observing so to open it (*see Fig.* 2) and lay it on the funnel that a sufficient interval be left between the two to permit of the free percolation of the liquid. (*See Fig.* 3.)

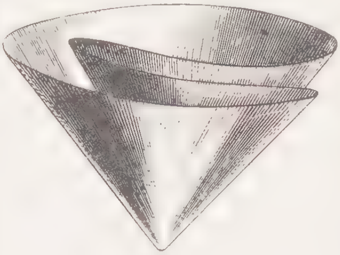


Fig. 1.

To promote the same object, a funnel should be deeply ribbed inside, or small rods of wood or glass, or pieces of straw, or quills, should be placed between it and the paper. The neck of a funnel should also be deeply ribbed or fluted outside, to permit of the free outward passage of the air when it is placed in a narrow-mouthed bottle or receiver. Unless this is the case, the filtration will proceed but slowly, and the filtered liquid will be driven up the outside of the neck of the funnel by the confined air, and will be continually hissing and flowing over the mouth of the vessel. The breadth of a funnel, to filter well, should be about three-fourths of its height, reckoning from the throat or neck. If *deeper,* the paper is liable to be continually ruptured from the pressure of the fluid; and when *shallower,* filtration proceeds slowly, and an unnecessa-

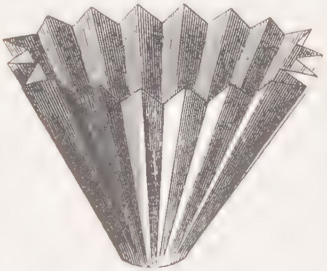


Fig. 2.

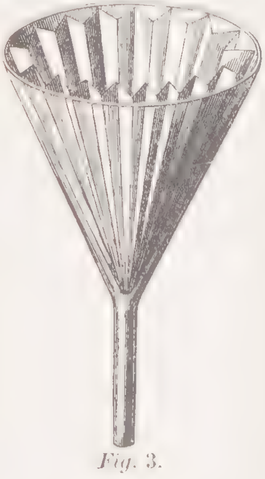


Fig. 3.

rily large surface of the liquid is exposed to evaporation. To lessen this as much as possible, the upper edge of the glass is frequently ground perfectly smooth, and a piece of smooth plate-glass is laid thereon. When paper filters are of large dimensions, or for aqueous fluids that soften the texture of the paper, or for collecting heavy powders or metallic precipitates, it is usual to support them on linen or muslin to prevent their breaking. This is best done by folding the cloth up with the paper and cutting the filter out of the two, in the same way as would be done with doubled paper, observing so to place it in the funnel that the paper and muslin may remain close together, especially towards the bottom.

The filtration of small quantities of liquids, as in chemical experiments, may often be conveniently performed by merely placing the paper on the circular top of a recipient; or on a ring of glass or earthenware laid on the top of any suitable vessel. A filter of this kind, that will hold one fluid ounce, will filter many ounces of some liquids in an hour.

Good filtering paper should contain no soluble matter, and should not give more than one two hundred and fiftieth to one two hundred and thirtieth of its weight of ashes. The soluble matter may be removed by washing it, first with *very dilute* muriatic acid, and secondly with distilled water.

For filtering a larger quantity of a liquid than can be conveniently managed with a funnel, and also for substances that are either too viscid or too much loaded with feculence to allow them to pass freely through paper, conical bags made of flannel, felt, twilled cotton cloth or *Canton* flannel, linen, or muslin, and suspended to iron hooks by rings or tapes, are commonly employed. (*See Fig.* 4.) The first two of the above substances are preferable for saccharine, mucilaginous, and acidulous liquids; the third for oily ones; and the remainder for tinctures, weak alkaline lyes, and similar solutions. These bags have the disadvantage of sucking up a considerable quantity of the fluid poured into them, and are therefore objectionable, except for large quantities, or when continued in actual use as filters for some time. On the large scale, a number of them are usually worked together, and are generally enclosed in cases to prevent evaporation, and to exclude dirt from the filtered liquor that trickles down their outsides.

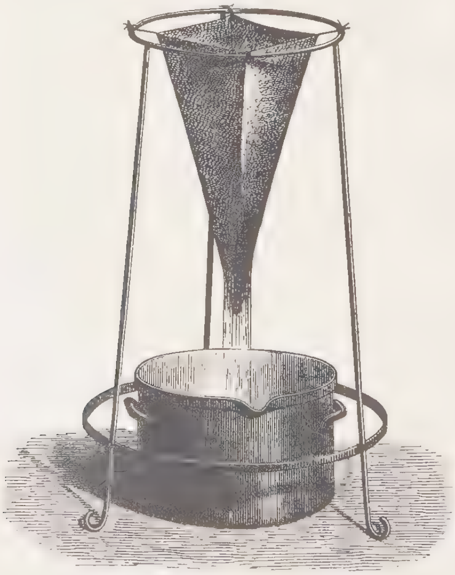


Fig. 4.

A very simple mode of filtering aqueous fluids, which are not injured by exposure to the air, is to draw them off from one vessel to another, by means of a number of threads of loosely twisted cotton or worsted arranged in the form of a syphon. The little cotton rope at once performs the operations of decantation and filtration. This method is often convenient for sucking off the water from small quantities of precipitates.

When pulverulent substances, as *sand, coarsely-powdered charcoal,* etc., are employed as the media for filtration, vessels of wood, or stoneware, are employed to contain them and the supernatant liquid. In these cases, the filtering medium is usually arranged as a shelf or diaphragm, and divides the vessel into two compartments; the upper one being intended to contain the liquid, and the under one to receive the same when filtered. Such an apparatus is set in operation by merely filling the upper chamber, and may, at any time, be readily cleaned out by reversing it and passing clean water through it in an opposite direction. The following is a filter of this description, and very simple in its arrangement. (*See Fig.* 5.) *A* is a common cask, *B* and *C* are false bottoms, fitting in perfectly air tight, but perforated with one-fourth inch holes. *C* should be covered with canvas, and above that a sheet of cotton wadding; above the wadding is a bed of *perfectly clean* sand, 3 inches deep. The sand should be covered over with flannel, and above the flannel should be a bed of *granulated* animal charcoal (*sifted* and *fanned from the dust*), 4 inches in depth. After having done this, fit in the false bottom, *B*, and cover it with a piece of cotton cloth. *D* is a bag made of Canton flannel to prevent the liquor being filtered from coming with too much force upon the false bottom. By substituting cotton wadding instead of the charcoal in the above filter, a fine filter for brandy and other liquors may be obtained.

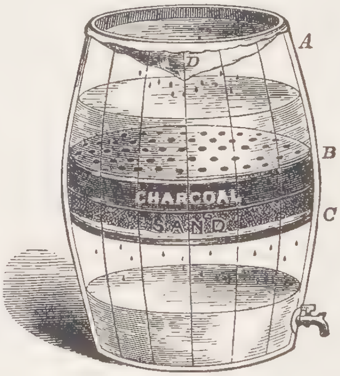


Fig. 5.

A filter which possesses the advantages of being easily and cheaply cleaned when dirty, and which very thoroughly purifies brandy or water with great rapidity, may be formed by placing a stratum of sponge between *two perforated metallic plates,* united by a central screw, and arranged in such a manner as to permit of the sponge being *compressed* to any required degree. Brandy or water, under gentle pressure, flows with great rapidity through the pores of compressed sponge.

It is often of great advantage to render a filter self-acting, or to construct it in such a way that it may feed itself, so that it may continue full and at work without the constant attention of the operator. On the *small scale,* this may be readily effected by an arrangement as represented in Fig. 6; and on the *large scale* by placing the vessel containing the unfiltered liquid on a higher level than the filter, and by having the end of the supply-pipe fitted with a ballcock, to keep the liquid in the filter constantly at the same height. (*See No.* 3840.)

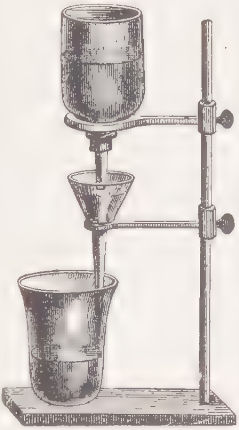


Fig. 6.

The rapidity of filtration depends upon the *porosity of the filtering medium — the extent of filtering surface—the relative viscidity or limpidness of the filtering liquid, and the porosity and fineness of the substances it holds in suspension.* The most efficient filter is produced when the first two are so graduated to the latter, that the liquid filters rapidly and is rendered perfectly transparent. (*See No.* 3838.) (*Cooley.*)

Tinctures and dilute spirits are usually filtered through bibulous paper placed on a funnel, or through thin and fine cotton bags. In general, tinctures clarify themselves by the subsidence of the suspended matter, when allowed to repose for a few days. Hence it is the bottoms alone that require filtering; the supernatant clear portion need only be run through a small hair sieve, a piece of tow or cotton placed in the throat of a funnel, or some other coarse medium, to remove any floating substances, as pieces of straw, &c. *Spirits* largely loaded with essential oil, as those of aniseed, &c., run rapidly through paper or muslin, but usually require the addition of a spoonful or two of magnesia before they will flow *quite* clear. When possible, tinctures, spirits, and all similar volatile fluids, are better cleared by subsidence or clarification than by filtration, as, in the latter way, part is lost by evaporation. (*See Nos.* 3834, &c.)

18. Gun-cotton as a Filter. Gun-cotton, carefully prepared, is scarcely acted on by the most energetic chemical agents at ordinary temperatures. It may therefore be used as a filter for solutions containing strong acids, alkalies, etc.

19. Fusion. *Aqueous* fusion is the dissolving of crystalline compounds in their own water of crystallization, by the application of heat. *Igneous* fusion is a term applied to the liquefaction of bodies by heat alone. The containing vessels used for igneous fusion should be of a material capable of sustaining the requisite degree of heat without either melting or cracking. Crucibles made of very refractory clay are used for high temperatures, metallic or earthenware vessels for lower degrees of heat.

20. Granulation. The reduction of metals into grains, drops, or coarse powder. This is done by pouring them, in the melted state, into water. The same effect is obtained by violently agitating the molten metal until cool, in a wooden box, well chalked inside. (*See No.* 25.) In many cases the metal is allowed to run through the holes of a kind of colander or sieve to produce minute division; if the drops are allowed to fall from a sufficient height, they will become spherical; in this way lead shot is made.

21. Liquation. The process of sweating out, by heat, the more fusible metals of an alloy.

22. Liquefaction. The conversion of a solid into the liquid state, either by heat—*fusion,* (*see No.* 19); absorption of water from the air—*deliquescence;* or the action of a fluid body—*solution.* (*See No.* 29.) The liquefaction of gases and vapors is effected by pressure and cold.

23. Lixiviation. The process of disolving out or extracting the saline matter of bodies, more especially of ashes, &c., by means of ablution or digestion in water. The solution so obtained is called a lye or lixivium, and the salts resulting from the evaporation of such solutions, lixivial salts.

24. Precipitation. This is the method for obtaining solid matter, by mixing two or more solutions of substances containing certain elementary equivalents which have a strong mutual chemical affinity. That fluid which is added to another to produce precipitation is called the *precipitant.* If a solution is to be precipitated, it is best, unless otherwise directed, to first heat it by means of a sand bath. (*See No.* 4.) A tall bell-shaped glass with a mouth is the best for precipitating. The precipitant is to be added gradually, stirring the mixture continually with a glass rod, until precipitation ceases. The liquid should then be allowed to settle until clear. In order to ascertain whether there is any matter left in the liquid unprecipitated, let one drop of the precipitant fall into the mixture; if any signs of precipitation ensue, more must be added; if the mixture remains unchanged and clear, the operation is complete. The liquid may then be carefully decanted and the precipitated matter, which is called a *precipitate,* filtered and dried. When the precipitate is the chief object of the process, it is usually necessary to wash it after filtration. This operation requires but little attention when the precipitate is insoluble in water; but when it is *in some degree* soluble in that liquid, great attention is required to prevent the loss which might result from the use of too much water. Precipitates soluble in water, but insoluble in alcohol, are frequently, on a small scale, washed with spirit more or less concentrated. (*See No.* 14.)

25. Pulverization. The reduction of

any substance to dust or powder is generally performed by means of a pestle and mortar, or, on a larger scale, by stamping, grinding or milling. A few soft substances, as carbonate of magnesia, carbonate of lead, &c., may be pulverized by simply rubbing through a fine sieve; while many hard and gritty, and some soft substances, such as chalk, antimony, &c., are pulverized on a large scale by elutriation. (*See No.* 14.) Others will only yield to a rasp or file. Whichever method is adopted, the substance to be pulverized must be very dry, and may even require artificial drying or desiccation. (*See No.* 12.) On the other hand, a few substances, as rice, sago, nux vomica, &c., are often soaked in water, or steamed, before being pulverized. In some cases, some other substance or *intermedium* is introduced to aid in the operation; thus, sugar is used in pulverizing civet, musk, nutmeg, and vanilla; absorbing the moisture which could not otherwise be readily got rid of. The addition of a very small quantity of alcohol renders the powdering of camphor easy. Gold leaf is pulverized by mixing with sulphate of potassa, and then removing the potassa by washing with water. (*See also No.* 2517.) Fusible metals are reduced by melting and rubbing in a mortar until cold, or by agitating when melted in a box covered inside with chalk or whiting. Glass, quartz and silicated stones require to be heated red hot and then thrown into cold water, to make them sufficiently friable for pulverization. When powdering very dusty or costly articles in a mortar, it should be covered with a loose skin of leather, fastened firmly round the top of the mortar and the pestle, to prevent loss of the dust, and possible injury to the operator's lungs. When a substance is required to be reduced to an impalpable powder, a slab and muller are used; this process is termed *porphyrization.*

26. Reduction. This term is applied to a process by which the oxygen is withdrawn from a metallic oxide, leaving the base in its original state. This is effected by heating the oxide with carbon or hydrogen; or by exposing it to the action of some other body which has a powerful affinity for oxygen. A portion of the metallic oxide to be reduced, is mixed with finely powdered charcoal and exposed in a crucible to the heat of a furnace. The metallic residue, which remains after reduction by this means, is usually mixed with coal dust. This is prevented by lining the crucible with charcoal dust made into a dough with clay and water, leaving a space in the middle to receive the metallic oxide, *not mixed* with charcoal, as in the former instance; the crucible must be covered, and then heated. The reduction in this way is slower, but the metal will be pure and free from coal dust.

When hydrogen is employed for reduction, the metallic oxide is heated to redness in a glass or porcelain tube, and subjected to a current of hydrogen gas, which absorbs the oxygen, and leaves the metal pure. Other agents are sometimes used for reducing, as tallow, oil, resin, sugar, and starch; but carbon and hydrogen are the agents generally employed.

27. Saturation. A liquid is said to be saturated with some other substance when it ceases to dissolve any more of it. An acid is saturated with an alkali when sufficient of the alkali has been added to completely neutralize the acid, and vice versa.

28. Sifting. This is a means employed to obtain uniformity of fineness in a pulverized substance; and is also of use in mixing different substances powdered to the same degree of fineness. The sieves used for this purpose are furnished with cloths of various materials and different degrees of fineness; consisting of brass wire, horse hair, buckram, book muslin, gauze, or raw silk; this last constituting a bolting cloth for sifting impalpable powders. These are stretched over a wooden cylinder in the same manner as the head of a drum. During the process of pulverizing, the use of the sieve is necessary from time to time to separate the finer powder from the coarser particles, which have to be returned after each sifting, to the mortar for further trituration. The powder is made to pass through the meshes of the sieve by gently agitating it between the hands; a rough jarring motion will force through some of the coarser particles, and destroy the uniformity of the powder. A sieve should be fitted with a drum head, top and bottom, the upper one to confine the dust of the substance being sifted, and the lower one to catch the sifted powder as it falls through the sieve. An arrangement of this kind is called a drum or box sieve.

29. Solution. Under the head of solutions, are properly included only those liquids which consist of water or an aqueous menstruum, in which has been dissolved an appropriate quantity of any soluble substance to impart to the liquor its peculiar properties. When spirit is the dissolving medium, the liquid receives the name of *alcoholic solution, spirit,* or *tincture,* while substances dissolved in water form *aqueous solutions.* In cases where a substance is dissolved in an acid or alkaline solution, whose acid or alkali is afterwards neutralized by means of an alkali (to counteract the acid), or an acid (to destroy alkali), the solution is then termed a *neutral solution.* A saturated solution is a solution made according to No. 27.

Professor Youmans, in the "Hand Book of Household Science," says: "Solids should be crushed or pulverized, to expose the largest surface to the action of the solvent liquid. Substances which in the lump would remain for days undissolved, when reduced to powder are liquefied in a short time. When a solid, as common salt or alum, is placed in a vessel of water to dissolve, it rests at the bottom. The water surrounding it becomes saturated, and being heavier, remains also at the bottom, so that the solution proceeds very slowly. By stirring, the action is hastened, but this takes up much time. The best plan is to suspend the salt in a colander, basket, or coarse bag, at the surface of the liquid. As the particles of water take up the particles of salt, they become heavier and sink; other particles take their places, dissolve more of the salt, and sink in turn, so that the action of a constant current of liquid is kept up on the suspended crystals, and always at that portion most capable of dissolving them."

30. Sublimation. The process by which volatile solid substances are reduced to the state of vapor by heat, and again condensed in solid form. It differs from ordinary distillation only in being confined to dry solid substances, and in the heat employed being, in general, much greater. Calomel, corrosive sublimate, and sal ammoniac, are thus prepared.

31. Trituration. The reduction of a solid body to powder by rubbing. This is effected on a small scale by means of a pestle and mortar; and on a large scale by grinding in a mill, or with a muller or a slab made of porphyry or other hard substance; this latter is termed *porphyrization.*

32. Washing. This is resorted to in chemistry for two widely different purposes. When a substance contains both soluble and insoluble matter, the soluble portion can be separated from the insoluble by washing; this is called *Lixiviation.* (*See No.* 23.)

When it is desired to cleanse or remove impurities from an insoluble powder, this is also effected by washing. (*See Nos.* 14 *and* 3841.)

Preparations.

The following methods of preparing decoctions, extracts, tinctures, &c., are from the best practical sources. Other directions for making extracts, essences, attars, &c., for the special purposes of Perfumery, &c., will be found under their respective headings.

34. To Prepare Decoctions. Decoctions are solutions of the properties of vegetables obtained by boiling, which is presumed to be a more effective method of extracting their properties than mere infusion.

For making decoctions, the substances should be well bruised, or reduced to a *very coarse* powder, or, if fresh and soft, they should be sliced small. In the former case, any *very fine* powder or *adhering dust* should be removed with a sieve, as its presence would tend to make the product thick and disagreeable, and also more troublesome to strain. The vessel in which the boiling is conducted should be furnished with an accurately fitting cover, the better to exclude the air, and the heat should be so regulated that the fluid may be kept "*simmering,*" or only *gently boiling,* as *violent* boiling is not only quite unnecessary, but absolutely injurious. In every case the liquor should be strained while *hot,* but *not* boiling, and the best method of doing this is to employ a fine hair sieve, or a coarse flannel bag. In general it is found, that as decoctions cool, a sediment is formed, in consequence of the boiling water dissolving a larger portion of vegetable matter than it can retain in solution when cold. This deposit for the most part consists of the active principles of the solution, and should be mingled with the clear liquid by agitation, when the decoction is used. It will thus be seen that the common practice of leaving the filtration until the liquid has become cold, and also of rejecting the sediment, is injudicious, and should be scrupulously avoided; as, however much decoctions so prepared may please the eye, they are not only *inferior in strength,* but, in many cases, *nearly inert.* It may be further remarked, that long boiling is in no case necessary, and should be avoided, especially in decoctions prepared from aromatic vegetables, or those abounding in extractive. The colleges, in such cases, direct the ingredients "to be boiled for a *short time,*" or "for 10 minutes," or they limit the time of boiling by stating the quantity that must be volatilized, as—"boil to a *pint,* and strain," the latter method being generally employed for those substances that do not suffer by lengthened boiling.

Distilled water, or perfectly clean *rain* water, should alone be used for decoctions. Spring and river water, from their containing lime, have less solvent powers.

Decoctions of all vegetables not exerting a *very powerful* action on the human system may be made by boiling 1 ounce of the vegetable matter in 1 pint of water for 10 or 15 minutes. The ordinary dose of such a decoction is the same as that of a similar infusion. (*See No.* 37.)

When the medicinal properties of vegetables are volatile, or are injured by a *strong* heat, infusion should be had recourse to, in preference to boiling; but when a solution of the fixed constituents is alone sought, decoction is preferable. In preparing compound decoctions, those ingredients should be boiled first which least readily impart their active principles, and those which most readily impart them should be added afterwards. In many cases it will be proper simply to infuse the more aromatic substances in the hot decoction of the other ingredients, by which means their volatile principles will be preserved.

35. To Prepare Tinctures. Tinctures are solutions of vegetable and animal drugs, and sometimes of mineral substances, in spirituous liquids. The spirit most commonly employed is proof-spirit; sometimes rectified spirit is used, and occasionally ether. Ammonia is sometimes conjoined with the spirit, in which case the solution is termed an ammoniated tincture. Rectified spirit is alcohol, with 16 per cent. of water, and its specific gravity is .838. Proof-spirit is composed of 5 parts of rectified spirit mixed with 3 parts of water, the resulting compound containing 47.5 per cent. of water, specific gravity .920. The choice between proof and rectified spirit depends on their respective solvent powers over the active principles of the drugs employed.

Tinctures are usually prepared by reducing the solid ingredients to small fragments, coarse powder, or fine powder, macerating them for 7 days or upwards in proof or rectified spirit, straining the solution through linen or muslin, or paper, and finally expressing the residuum strongly, to obtain what fluid is still retained in the mass. They are also prepared by the method of displacement. (*See No.* 41.) All tinctures should be prepared in close glass or stoneware vessels, and be shaken frequently during the process of maceration. Tinctures are better clarified by repose than by filtration, as in the latter case a considerable portion is retained by the filtering medium, and lost by evaporation. In ordinary cases, it will be sufficient to allow the tincture to settle for a few days, and then to pour off the clear supernatant portion through a funnel loosely choked with a piece of sponge or tow, to keep back any floating fragments of straw or other light substances; after which the remaining foul portion of the liquid may be filtered through paper. When it is absolutely necessary to filter a tincture, and the quantity is large, conical bags should be employed. The filtration should be conducted as rapidly as possible, for the double purpose of lessening the amount lost by evaporation, and the action of the air on the fluid. Tinctures long exposed to the air frequently lose their transparency within a few days after their filtration, owing to the oxidation and precipitation of some portion of the matter previously held in solution. Resinous and oily tinctures, as those of myrrh, tolu, and lavender, may be usually restored to their former brightness by the addition of a quantity of spirit, equal to that which they have lost by evaporation; but many tinctures resist this mode of treatment, and require refiltering. Ethereal tinctures are best prepared by percolation, and should be both made and kept in stoppered bottles.

When both the substances are fluid, as in the case of certain balsams, the spirituous solution is made by merely mixing the two together in suitable proportions. For instance —Tincture or essence of Tolu consists of 3 drachms balsam of Tolu and 1 quart of alcohol.

The tinctures of the drug-stores are usually very uncertain and inferior preparations. Not only is their manufacture carelessly conducted, without reference to the respective characters of their ingredients, but the ingredients themselves are often deficient in strength and quantity.

We will now proceed to explain the various methods by which good tinctures are obtained.

36. To obtain Tinctures by Infusion, Maceration, and Digestion. In order to extract the soluble principles of substances which cannot be advantageously distilled, infusion is often resorted to. This consists in submitting them for a greater or less period of time to the action of a liquid, with or without the aid of heat.

This is known by the name of infusion, digestion, or maceration, terms all signifying the same process with different modifications in the way of conducting it.

37. Infusion. When the principles to be extracted are soluble in water, and at the same time but slightly volatile, boiling water is poured on the substance of which the infusion is required, the vessel is carefully covered, and the whole allowed to remain untouched for some minutes or even some hours, according to the greater or less penetrability of the substance, and the required strength of the infusion; the result is an INFUSION, properly so called.

If an infusion is required of dried leaves or flowers, they are first moistened with a little boiling water, and a time allowed for them to swell and soften before adding the rest of the water. Infusions made by adding all the water at once, as is still frequently practiced, are deficient both in flavor and perfume. The infusion of tea is an every-day illustration of this; as all who can make a good cup of tea know how necessary it is to first *draw* the tea with a small portion of water; and yet, strange to say, this principle is utterly neglected in the case of coffee, where its application is just as effective. (*See French Coffee.*)

Infusions of all vegetables that do not exert a *very powerful* action on the human frame, may be made by pouring 1 pint of boiling water on 1 ounce of the vegetable matter and allowing it to macerate for from ½ to 1 hour. *The ordinary dose* of such infusions is 1 to 2 ounces three or four times a day.

Infusions, like decoctions, are liable to undergo spontaneous decomposition by keeping, especially in warm weather, when a few hours are often sufficient for their passage into a state of active fermentation; they should therefore be prepared for use daily, as beyond 24 hours they cannot be depended on.

Infusions should be made in vessels which cannot be attacked by any of the substances with which they are in contact, and closed sufficiently tight to prevent the loss of the most volatile principles.

The tin cucurbit, with cover, is in these two respects best adapted for infusions in water.

38. Concentrated Infusions. These are now very generally met with in trade, and are made of 8 times the pharmacopœial strength. They are mostly prepared by employing 8 times the usual quantity of ingredients, and only three-fourths of the proper quantity of water, and adding to the strained liquor, when cold, sufficient spirit of wine to bring the liquid up to the proper strength (about one-third of the weight of the strained infusion). A still better plan is to treat 8 times the usual quantity of the ingredients with a mixture of rectified spirits 1 part and cold water 3 parts; in the usual way for making tinctures, either by *maceration* for 7 to 14 days, or by *percolation.* Concentrated infusions made in this way keep well, and deposit scarcely any sediment. Many houses, that are remarkable for the brilliancy and beauty of these preparations, employ one-third spirit of wine and two-thirds water as the menstruum. It may, however, be taken as a general rule, that for vegetable substances that abound in woody fibre, and contain but little extractive matter soluble in water (as quassia for instance), one-sixth to one-fifth part of spirit is sufficient for their preservation; while for those abounding in mucilage or fecula, or that readily soften and become pulpy and glutinous in *weak* spirit (as rhubarb), one-fifth to one-third is required. By macerating in the infusion as much bruised mustard seed as can be added without flavoring the liquor, along with a little bruised cloves, most vegetable infusions may be preserved without either fermenting or becoming mouldy with very little spirit (one-ninth or one-tenth).

39. Maceration. When an infusion is made without the aid of heat it is termed maceration. This takes a much longer time than an infusion, properly so called; it rarely requires less than 7 days, sometimes several weeks. Those substances to which heat would be injurious, or which are easily soluble, are treated in this way. In many distillations this method is made use of to soften the substances before putting into the still; and to facilitate the extraction of their odorous principle.

Tinctures, when prepared by maceration, should be frequently shaken during the process, which should be conducted in glass vessels well stopped.

40. Digestion is a prolonged infusion which is usually conducted at a medium temperature between that required for an *infusion*, properly so called, and that of a *maceration*. Its object is usually to impregnate alcohol with the principles of a substance which would be but slowly extracted without the aid of a certain amount of heat, such as that of the sun or of hot ashes.

Mixing together two or more liquors and allowing them to stand for some days, is also called digestion.

Maceration and digestion are usually performed in vessels of stoneware or glass, which are placed on the sand-bath, in cases where a regular and uniform heat is required.

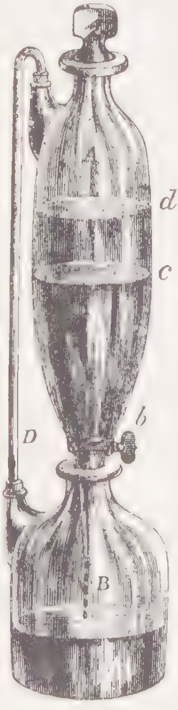
Whatever may be the form or nature of the vessels employed, care must be taken not to fill them full, also to cover those which are to be placed on the sand-bath with a damp piece of parchment tightly tied round the top, with many pin holes pricked in it. If this latter precaution be neglected, the increased volume produced by the heat and also the expansion of the air may burst it. Moreover, the process is never so well conducted in a vessel that is too full.

41. To obtain Tinctures by Displacement or Percolation. The kind of filtration commonly called the *process of displacement*, for extracting the essence from roots, herbs, seeds, barks, &c., is effected in the following manner: It is first necessary that the articles to be acted upon should be ground in a drug mill to the condition of a coarse powder; then weigh each powder by itself, and mix them together in the proportions demanded by the recipe, and moisten the mass thoroughly with alcohol, allowing it to *macerate* for 12 hours in a vessel well covered. Next is required a hollow instrument of cylindrical form, having one end shaped liked a funnel, so that it can be inserted in the neck of a glass bottle, and having inside, near the lower end, a partition pierced with numerous small holes, like the strainer of a French coffee-pot, which is a simple coffee percolator; in the absence of such a partition, soft cotton, or any insoluble substance, may be substituted, and being placed in the inside at the lower end of the instrument, will answer as well as the strainer. This instrument is called a percolator. Boullay's filter or percolator is usually employed. Macerate the ingredients to be acted upon, for the time named—introduce them into the percolator, and slightly press them upon the partition. Any portion of the liquid used in the maceration, not absorbed by the powder, should be poured upon the mass in the instrument, and allowed to percolate. Now gradually pour into the percolator sufficient of the alcohol, or other liquid to be filtered, to drive before it, or *displace*, the liquid contained in the mass; the portion introduced must in like manner be *displaced* by another portion; and so on, till the required quantity of filtered liquor is obtained. This extract is called a tincture. In case the liquor which first passes through should be thick and turbid, again introduce it into the instrument, being very careful not to have the powder too coarse or loosely pressed, or it will permit the liquid to pass too quickly; and on the other hand it should not be too fine and compact, or it may offer an unnecessary resistance. Should the liquor flow too rapidly, return it to the instrument, and close it beneath for a time, and thus permit the finer parts of the powder to subside, and cause a slower percolation.

The method of percolation is now preferred by all who have made sufficient trial of it to apply it correctly.

The first portion of liquid obtained by the method of displacement is always in a state of high concentration. In general it is a simple solution of the soluble ingredients of the crude drug in the fluid employed. But sometimes the solvent, if compound, is resolved into its compound parts, and the fluid which passes through it at any given time is only *one* of these, holding in solution only the most soluble parts of the drug.

Thus, if diluted alcohol be poured over powder of myrrh, in the cylinder of the percolator, the fluid which first drops into the receiver is a solution of an oily consistence chiefly composed of resin and volatile oil dissolved in alcohol. In like manner when the powder of gall-nuts is treated in the same way by hydrated sulphuric ether, two layers of fluid are obtained, one of which is a highly concentrated solution of tannin in the water of the ether, and the other a weak solution of the same principle in pure ether. In all cases, therefore, in which it is not otherwise directed, it is absolutely necessary to agitate the several portions of the liquid obtained by percolation together, in order to insure a product of uniform strength, or activity.



To illustrate the operation of displacement, and describe an excellent percolator for making perfume tinctures, we will suppose that benzoin is under treatment. The apparatus made wholly of glass, having been arranged as shown by the engraving, and a plug of raw cotton dropped loosely at *b*, the benzoin in coarse powder is then poured into the tube portion, *A*, until it reaches the line, *c*. Alcohol (95 per cent.) is next added, until it rises to the line, *d*. As soon as the first portion sinks into the benzoin, a fresh addition must be made; and thus the succeeding relays go on displacing those which preceded them without mingling with them. Each stratum becomes more and more charged with soluble matter as it descends; and when it reaches the bottom of the mass, under the pressure of the superincumbent liquor, it runs out saturated. When, by successive additions of fresh alcohol, the benzoin under treatment has become exhausted, the liquid passes through the mass, and falls into the receiver, *B*, as tasteless and colorless as when first poured in. This indicates the completion of the process.

As atmospheric pressure is an important element in the operation, it will not answer to shut it off by closing the top of the displacer, without making some compensating arrangement; and, therefore, a communication between the upper and lower vessels is established by means of a latent-tube arrangement, *D*. In this manner the apparatus is kept close, and the evaporation of alcohol prevented, while the pressure produced is distributed throughout the apparatus, and rendered uniform. As the runnings are clear, filtration is rarely necessary. The quantity of alcohol thus consumed need not be more than sufficient to exhaust the material; and the resulting tincture must therefore be diluted to the proper strength. For perfumes, deodorized alcohol must always be used.

The method of displacement has the advantage of expedition, economy, and yielding products possessing uniformity of strength; but it requires considerable experience to adapt it to all substances. The art rests in properly packing the ingredients in the cylinder, some substances requiring considerable pressure to be used, while others, when even lightly packed, scarcely permit the fluid to pass through them. An excellent plan applicable to all substances, but especially those of a glutinous or mucilaginous nature, is to mix the powder with an equal bulk of well-washed sand, before rubbing it up with the menstruum. The coarseness of the powder must also be attended to. Substances that readily become soft and pappy when wetted by the menstruum, should not be used so fine as those that are more woody and fibrous. The method of displacement answers well for the preparation of all tinctures that are not of a resinous nature, and for most infusions of woody and fibrous substances, as roots, woods, barks, leaves, seeds, insects, &c. It is especially adapted for the preparation of concentrated infusions and essences, as they may thus be obtained of any required strength, without loss, or requiring concentration by heat, which is so destructive to their virtues.

When ordinary tinctures are made in *large quantities,* displacement is never likely to supersede maceration, on account of any practical advantages it may possess. If the prescribed directions be duly attended to, the process of maceration is unexceptionable. The process is more simple than the other; the mode of operating more uniform; it is, in fact, always the same; it requires less of skill and dexterity in conducting it; it requires less constant attention during its progress, which, in operating on large quantities, is a consideration; and finally, the apparatus required is less complicated. When, however, only small quantities of tincture are to be made at a time, and kept in stock, the adoption of the process of displacement will often be found convenient and advantageous. It offers the means of making a tincture in two or three hours, which, by the other process, would require as many weeks. (*See No.* 4572.)

42. Proportion of Ingredients used for making Tinctures. The following are the proportions usually employed for the most important perfume tinctures:

Tincture.		Troy.	Alcohol.
Vanilla	Vanilla bean, rasped	1 lb.	8 pts.
Musk	Grain musk	2 drachms.	8 pts.
Frangipani	Powder a la frangipani	1 lb.	6 pts.
Rhodium	Rhodium-wood, rasped	1 lb.	2 qts.
Civet	Civet, orris-root	½ oz	2 qts.
Tonquin	Tonka bean	1 lb.	8 pts.
Orris	Orris-root	7 pts	8 pts.
Alkanet—red col.	Alkanet	½ oz	1 qt.
Turmeric—yellow.	Turmeric	½ oz	1 qt.

43. To Prepare Emulsions. These are milky liquids, formed by the mechanical admixture of oil, balsam, or resin, with water, by means of some other substance that possesses the property of combining with both. There are numerous preparations of the kind in pharmacy and medicine, which, in the later pharmacopœias, have received the name of "mixtures." There are also several emulsions employed as cosmetics, either alone, or as vehicles for other ingredients. The common name of emulsions is "*milk,*" but the term is often incorrectly extended to opaque white liquids of an entirely distinct character.

The successful *preparation* of *emulsions* is a matter requiring some little skill and care. In some instances, as with the almond, the two substances necessary to produce a perfect emulsion are presented by nature, ready to our hand, in the same vegetable production; nothing more is necessary than to reduce it with the pestle, and triturate it with water, gradually added. In other cases, and which are far the more numerous, we have to operate on oily or resinous ingredients in their common form. These we are enabled to suspend in water, or mechanically combine with it, by the intervention of *thick mucilage, almonds,* or *yolk of egg.* It is found that 1 drachm (60 grs.) of the *first*—made with equal parts of good *gum-arabic* and *water* (powdered gum is sometimes used instead of mucilage)—1 ounce of the *second,* (usually about 26 in number), and one of the *last,* will form 2 drachms of oil or resinous matter into an emulsion with about 1 fluid ounce of water, gradually added; and such an emulsion, if properly made, will then, in most instances, bear further dilution with water. (The *yolk* of an ordinary-sized hen's egg is referred to. It should be remembered, that emulsions formed with yolk of egg will not keep long, owing to the putrescible nature of the latter.) Of these, mucilage is the medium most commonly employed. According to Montgomery, for conversion into permanent emulsions, "*oils* require about three-fourths their weight; *balsams* and *spermaceti,* equal parts; *resins,* twice their weight; and *musk* and *ambergris* 5 times its weight." In some cases instead of the above substances, a little *liquor of potassa* is employed, when a saponaceous emulsion is formed, which differs considerably in its properties from an emulsion of the same ingredients produced by means of a bland medium.

In making an emulsion, the *gum,* or other medium employed, should be first put into the mortar, and rendered thoroughly homogeneous with the pestle. If *almonds* are used, they should be treated as noticed under "almond-paste" (*see No.* 1123), a few drops of water being added to prevent "oiling," and to reduce them to a smooth, soft paste. The oil or resinous matter may then be gradually added and rubbed in, carefully observing not to add it more quickly than it can be subdued by the pestle; and if, during this part of the manipulation, the mixture should begin to exhibit a "breaking" or "curdling" appearance at the edges, a few drops of water must be immediately incorporated with it, before adding the remainder of the oil. If this be not done, the emulsive mixture in the mortar will, in general, suddenly lose its tenacious consistence, and the process will fail. After the whole of the oil, balsam, or resinous matter is thoroughly incorporated, the water or other aqueous vehicle intended to form the bulk of the emulsion, should be added gradually and with care, each portion being perfectly blended with the liquid mass in the mortar, by patient trituration, before adding the next. If any alcoholic liquid is employed, it should be added at the very end of the process, and then only very gradually, as otherwise it will cause the separation of the ingredients.

It must be observed that soluble salts, spirit, acids, and astringents, are, as a rule, incompatible with the emulsive form. If saline matter must be introduced, it should only be added in a very minute quantity, and in the state of solution, to the ready-formed emulsion; and in this case emulsion of almonds is the most suitable vehicle. (*See No.* 1125.) Spirits and acids act by precipitating the mucilaginous matter, or yolk. Even the addition of a very little lemon juice, or of a portion of slightly acescent syrup, will often entirely destroy an emulsion. This inevitably occurs with emulsions made with liquor of potassa, or other alkaline medium, owing to the absolute incompatibility of acids and alkalies in the same liquid.

It is found that volatile oils are more readily made into emulsions if mixed with an equal volume of some simple fixed oil, as that of the almond or olive, before proceeding to operate on them.

All emulsions should be well shaken before use. (*Cooley.*)

44. To Prepare Extracts. The process of obtaining an extract of a substance involves two distinct operations: First, the production of a solution of the soluble portion of the substance operated on; and next, the reduction of this solution to a proper consistence by evaporation. The substance is first, where practicable, reduced to coarse powder by bruising, or sliced with a knife, so that every portion may be fully exposed to the action of the solvent. Refractory substances are first softened by the solvent and then sliced. Other substances whose nature does not require reducing, are used without preparation.

Different fluids are used for solvents, as best adapted to the solubility of the substance under treatment. Some bodies, such as fresh vegetables, yield their juice by expression alone. In the preparation of *aqueous* extracts, the ingredients are treated with rain or distilled water, until all the soluble matter that is desired to obtain from them is dissolved. This is effected by either *maceration, percolation, infusion,* or *decoction,* as circumstances require: the solution thus obtained is poured off and the remaining soluble matter either pressed or washed out, and added to the solution; it is next allowed time to settle, then decanted, and strained or filtered; and if this fails to render the liquid clear, it is clarified by white of egg, and filtered; Canton flannel, first soaked in water, being generally employed for this purpose. When water acidulated with acetic acid is employed, vegetable substances are usually macerated in it in the cold, or the dilute acid is sprinkled over the bruised plant, if fresh, and the juice expressed by strong pressure.

When the principles to be extracted are insoluble, or only slightly soluble, in water, alcohol is employed, either in the form of rectified spirit, proof spirit, or diluted. These produce *alcoholic* or *spirituous* extracts; and are generally obtained by either *maceration* or *digestion.*

Ether is well adapted for obtaining extracts from bodies whose principles consist of volatile oils or resin, on account of its strong affinity for those substances. Such are termed *ethereal* extracts. In nearly all cases, filtration is necessary to insure a pure extract.

The means usually employed for evaporating an *aqueous* solution, are rapid boiling over a fire until the extract is thick enough to offer some risk of burning, and the evaporation finished over a water bath or in shallow vessels at a moderate heat, the further escape of vapor being promoted by continuous stirring with a wooden spoon or stick. It is not always advisable to heat a solution to the boiling point, but if boiling is resorted to, it cannot be done too rapidly, as the heat cannot rise above its boiling point, and rapid ebullition hastens evaporation. The fluid must never be stirred while ebullition is going on.

Two fundamental rules are:—to conduct evaporation at as low a temperature as is consistent with other objects; and,—to exclude atmospheric air; or, at least, to expose the liquid to its action for as short a time as possible, as most solutions lose more or less of their active principles by heat and exposure. Solutions which will not bear boiling without loss of strength are evaporated in a vacuum, either in a closed still, or under the receiver of an air pump, in which a vessel is placed containing strong sulphuric acid; this has a powerful affinity for water and absorbs its vapor as quickly as it comes in contact with it.

A good plan for evaporation, though slow, is to place the liquid in a broad shallow vessel, exposed in a stove or drying room to a temperature of about 100° Fahr., allowing free access for the air. The extracts thus evaporated are said to be lighter in color and more transparent than by most other ways.

The method for evaporating an *alcoholic* or an *ethereal* solution is substantially the same as that pursued with an aqueous solution; except that, as a matter of economy, the vapor may be led off and condensed again.

A *good extract* should be free from grit, and wholly soluble in 20 parts of the solvent used for making the extract, forming a nearly clear solution; it should be of a proper consistence and of uniform texture and color, smooth and glossy in appearance; this latter can only be arrived at by assiduous and laborious stirring as the extract thickens; and may be promoted by adding 3 or 4 per cent. each of olive oil and gum arabic, with 1 or 2 per cent. of spirit of wine. Extracts should be put into pots as soon as made, securely tied down with bladder, and kept in a dry place. Any tendency to become mouldy may be prevented by adding, the last thing before removing from the evaporating pan, a few drops of oil of cloves, or a still less quantity of creosote, dissolved in a little alcohol; or by moistening with oil of cloves or creosote, the inside of the bladder used for covering the pots.

45. To obtain Vegetable Juices by Expression. The juices of plants are obtained by bruising the fresh leaves in a marble mortar, or in a mill, and expressing the juice which, after *defecation* for some hours in a cool situation, is either filtered through paper, or strained after coagulating its albuninous matter by heat. Some plants require the addition of ⅛ its quantity of water before pressing. The expression of the juice of lemons, oranges, quinces, &c., is facilitated by previously mixing the pulp with clean chopped straw. Mulberries, &c., after being crushed between the hands, are left 3 or 4 days to undergo a slight fermentation, before pressing. A very powerful screw press is required for this purpose. The PRESERVATION of the juices of the narcotic plants, and some other vegetables, has lately assumed considerable interest, from these preparations having been proposed as substitutes for the common tinctures. It appears that the juice of young plants just coming into flower, yields only ⅔ the amount of extract which may be obtained from the same quantity of juice expressed from the matured plant, or when the flowers are fully blown; and the strength of the product is also inferior. The leaves alone should be preferably employed, and should be exclusively of the second year's growth, when the plants are biennials.

Bruise the leaves in a marble mortar (on the large scale, in a mill), and submit them to the action of a powerful press; allow the juice to remain for 24 hours in a cold place, then decant the clear portion, add ¼ part by measure of spirit (90 per cent.), agitate, and in 24 hours again decant the clear, and filter it through paper. Keeps well under ordinary circumstances.

The method directed by the *Paris Codex* is as follows: to the fresh leaves, bruised in a marble mortar, is added an equal weight of rectified spirit, and after *maceration* for 15 days, the whole is pressed, and the resulting tincture filtered.

The commencing dose of the narcotic juices is about 5 drops. In the above manner are prepared the *preserved juices of aconite, belladonna, colchicum* (corms), *hemlock, henbane, foxglove, lactuca virosa, taraxacum,* &c.

46. To Extract Essential Oil from Wood, Barks, Roots, Herbs etc. Take balm, mint, sage, or any other herb, &c., put into a bottle, and pour upon it a spoonful of ether; keep in a cool place a few hours, and then fill the bottle with cold water; the essential oil will swim on the surface, and may be easily separated.

Specific Gravity is the density of the matter of which any body is composed, compared with the density of another body, assumed as the standard, or 1.000. This standard is pure distilled water for liquids and solids, and atmospheric air for gaseous bodies and vapors. In the United States and England the specific gravity, unless when otherwise expressed, is always taken at 60° F.; but in France at 32°, or the temperature of melting ice. In most cases, however, it is sufficient merely to note the temperature, and to apply a correction, depending on the known density of water or air, at the different degrees of the thermometric scale.

The above plan has been adopted, because the weight of an equal *bulk* of different substances varies greatly. Thus, as gold is 19 and silver 10 times heavier than water, those numbers, 19 and 10, are said to represent the specific gravity of gold and silver. The heaviest of all known substances is the very hard metal used for making points to the so-called diamond gold pens. It is called iridium; its specific gravity is 23. Next comes platinum, 21; gold, 19; mercury, 13.5; lead, 11.3; silver, 10; copper, 8; iron, 7; zinc, 6; different kinds of stones, from 4 to 1; aluminum, 2.5. Flax and all woody fibres have a specific gravity of 1.4, and are thus heavier than water, but wood will float or sink according to the number of its pores into which the water does not penetrate. So ebony and many kinds of hard wood sink, pine and all kinds of soft wood float. Cork is the lightest wood, its specific gravity being only 0.24, less than one-quarter that of water. Alcohol is about three-quarters the weight of water, and as the strength of liquor depends on the amount of alcohol it contains, this strength is simply found out by its specific gravity indicated by the more or less floating of a little instrument called a hydrometer, the weaker liquid being little lighter than water has the strongest buoyant power; solutions of different salts, sugar, etc., being heavier than water, have a stronger buoyant power; vessels therefore will draw less water in the sea than in fresh water, and it is more difficult to swim in the latter than in the sea. The lightest of all liquids has a specific gravity of 0.6; it is called chimogene, and is made from petroleum; it is exceedingly volatile and combustible; in fact, it is a liquefied gas. Carbonic acid gas or choke damp is about 500 times lighter than water; common air, 800; street gas about 2,000, and pure hydrogen, the lightest of all substances, 12,000 times. The heaviest substance has thus 23×12,000 or more than a quarter of a million times more weight than an equal bulk of the lightest; and the substance of which comets consist, has by astronomers been proved to be even several thousand times lighter than hydrogen gas.

48. To find the Specific Gravity of a Substance heavier or lighter than Water. In order to ascertain the specific gravity of a body heavier than water, the following method is adopted. First weigh it in air, then weigh it immersed in water. The difference between these two weights will be its *loss* of weight in water, or, in other words, the weight of the water displaced. Then divide the weight in air by its loss in water, and the result is the specific gravity.

Thus, suppose a substance weighs,

12 pounds in air,
and 10 pounds in water.
—

Its *loss* is 2 pounds in water.

Divide 12 (weight in air) by 2 (loss in water), and the result is its specific gravity, 6.—That is, the substance is, *bulk for bulk*, 6 times as heavy as water.

If the substance will not sink in water, then weight must be added to make it *just sink* below the surface. This extra weight, *added to* the weight in air, show its *loss* in water. Thus, if a substance weighs 8 pounds in air, but requires 2 pounds to be added to submerge it in water, its *loss* of weight in water is 2 added to 8=10 pounds.

Proceeding as before, we divide its weight in air, 8, by its loss in water, 10 and we have it specific gravity $\frac{8}{10}$=.8.

49. To find the Specific Gravity of a Liquid or a Gas. Weigh it in a specific gravity bottle, glass flask, or other vessel of known capacity; and dividing that weight by the weight of the same bulk of water, the quotient is, as before, the specific gravity.

50. To find the Specific Gravity of a Solid Body Soluble in Water. Take its specific gravity in regard to some liquid which does not dissolve it, and multiply by the specific gravity of the liquid. Thus, a piece of sugar, whose weight is 400 grains, is found to lose 217.5 grains if weighed when immersed in oil of turpentine; this would make its specific gravity, as compared with oil of turpentine, $\frac{400}{217.5}$=1.84. The specific gravity of the turpentine is .87; then, 1.84×.87=1.6, the real specific gravity of the sugar.

51. To find the Specific Gravity of a Body in Powder Insoluble in Water. Introduce it into a bottle whose capacity is known; fill the bottle with pure water at 60°. It will hold as much less water as is equal to the bulk of the powder, and the weight of the powder in air divided by this difference will give the specific gravity. Thus, supposing the bottle to hold 1000 grains of water, 100 grains of emery are introduced, and the bottle filled up with water. If no water were displaced the two should weigh 1100 grains; they really weigh 1070; the difference, 30 grains, is the weight of water displaced; 100÷30=3.333, specific gravity of the emery.

52. To Determine the Weight of a Body from its Specific Gravity. A cubic foot of water weighs 1000 ounces; hence, to determine the weight of a given bulk of any body the specific gravity of which is known, multiply the cubic content in feet by 1000, and this by the specific gravity, and the product will be the weight in ounces avoirdupois.

Alcoholmetry. The percentage of absolute alcohol in any spirituous liquid may be given either by *volume* or weight, but as liquors are sold by measure, not weight, it is generally preferred to know the percentage by volume. The per cent. of weight remains the same in all temperatures, but the per cent. by volume varies with the temperature or heat of the liquid. Many instruments have been introduced to determine the quantity of absolute alcohol contained in any spirituous liquors, and these are known as *hydrometers*, or *alcoholmeters*. Hydrometers made by different inventors have come into use in different countries; thus the hydrometer made by Tralles has been adopted by the governments of the United States and Prussia; that made by Gay Lussac has been legally sanctioned in France and Sweden; while that invented by Sikes has been approved and made the excise standard in Great Britain.

54. Tralles' Hydrometer. Tralles' hydrometer is the instrument used by our government to ascertain the strength of *imported* liquors, and is made of glass. Tralles has adopted as the standard of comparison pure or absolute alcohol in volume at the temperature of 60° Fah., the strength of which he expresses by a scale divided into 100 degrees or parts, each of which represents $\frac{1}{100}$ part of alcohol. When floated in any spirituous liquor at a temperature of 60° Fah., it immediately indicates the strength. For instance, if in a brandy at that temperature it sinks to 65, it shows that 65 parts of the liquor is absolute alcohol, and 35 parts water; should it sink to 90, it indicates that the liquor is 90 parts or per cent. strong, and so on.

An increase of heat causes liquids to expand in volume, and a decrease produces contraction; therefore spirits over the normal temperature of 60° Fah. appear stronger than they really are, and below 60° they are really stronger than they appear to be.

It is therefore evident that the degrees of percentage of this hydrometer are only correct when the spirit under trial *has* the normal temperature of 60° Fah. When the temperature varies from 60°, the percentage can only be ascertained by a long and tedious calculation. To avoid this Mr. Tralles has constructed a simple table by which the real percentage of alcohol is found in liquids of different temperatures from the results exhibited by the instrument. (*See No.* 55.) The horizontal line at the top shows the various temperatures given by the thermometer; the column of figures under 60° shows the *true* percentage of strength at the normal or standard temperature of 60°; the figures under the other degrees of temperature show the *observed* or *apparent* degrees of strength as indicated by the hydrometers.

As an example of the simple manner by which this table may be used, we will suppose that the temperature of the spirits to be tested is at 75°, Fah., and that the hydrometer sinks to 53° on the scale; this would be the *observed* or apparent degree or percentage of strength. Now to find the *real* percentage of strength at 60°, we turn to the table and find the upright or vertical column of figures headed 75°, we then run down the figures until we arrive at 53.0; having ascertained this, we then trace the horizontal line to the *left* or right to the outside column headed 60°, and at the point when the horizontal line running from 53.0 meets the column headed 60°, will be found the number 50. We thus ascertain that a spirit at 75° having an *observed* strength of 53 has only a *real* percentage of 50 at the normal or established temperature of 60°.

Suppose that another sample of brandy, instead of being at 75° is at 50°, and the instrument still sinks to 53. In the same way we select the column headed 50°, and run down the figures until we find 53.0, then by tracing the horizontal line until we arrive at the outside column headed 60° (either the first or last column), we find the number 55, which is the true percentage of the brandy at 60° Fah.

Again, if an alcoholic liquid at a temperature of 30° be found to contain 23.5 per cent. by volume, by reference to the table 30 will be found to express its actual strength at 60° Fah.

We might multiply examples, but the above are sufficient to show the manner by which the table may be worked.

55. **Table to find the true percentage of Absolute Alcohol** *by volume in a liquid at 60° from the observed percentage indicated by a Glass Hydrometer at any other temperature.*

60°	30°	35°	40°	45°	50°	55°	65°	70°	75°	80°	85°	60°
0	—0.2	—0.4	—0.4	—0.5	—0.4	—0.2	+0.2	+0.6	+1.0	+1.4	+1.9	0
5	+4.6	+4.5	+4.5	+4.5	+4.6	+4.8	5.3	5.8	6.2	6.7	7.3	5
10	9.1	9.0	9.1	9.2	9.3	9.7	10.4	11.0	11.6	12.3	13.0	10
15	13.0	13.1	13.3	13.5	13.9	14.5	15.6	16.3	17.1	18.0	19.0	15
20	16.5	16.9	17.4	17·8	18.5	19.2	20.8	21.8	22.8	23.8	24.9	20
25	19.9	20.6	21.4	22.2	23.0	24.1	25.9	27.0	28.2	29.4	30.5	25
30	23.5	24.5	25.7	26.6	27.7	28.8	31.1	32.2	33.4	34.5	35.7	30
35	28.0	29.2	30.4	31.6	32.7	33.8	36.2	37.3	38.4	39.5	40.6	35
40	33.0	34.2	35.4	36.7	37.8	39.0	41.1	42.2	43.3	44.3	45.4	40
45	38.4	39.6	40.7	41.8	42.9	43.9	46.1	47.1	48.2	49.2	50.3	45
50	43.7	44.7	45.8	46.9	47.9	49.0	51.0	52.0	53.0	54.0	55.1	50
55	49.0	50.0	51.0	52.0	53.0	54.0	54.9	56.9	57.9	58.9	59.9	55
60	54.2	55.2	56.2	57.1	58.1	59.0	60.9	61.9	62.9	63.8	64.9	60
65	59.4	60.3	61.2	62.2	63.1	64.0	65.9	66.8	67.7	68.6	69.6	65
70	64.6	65.5	66.4	67.3	68.2	69.1	70.8	71.7	72.6	73.5	74.5	70
75	69.8	70.7	71.5	72.4	73.3	74.2	75.8	76.7	77.6	78.4	79.3	75
80	75.0	75.8	76.6	77.5	78.4	79.2	80.8	81.7	82.4	83.2	84.1	80
85	80.3	81.1	81.8	82·6	83.5	84.3	85.7	86.5	87.3	88.0	88.8	85
90	85.6	86.4	87.1	87.9	88.6	89.3	90.7	91.4	92.0	92.7	93.4	90

The following table gives the *richness* or the per cent. of alcohol by volume, in reference to the volume of the liquid at the temperature when tested; it therefore requires that the liquor should be tested exactly at the same temperature at which it was measured.

56. **Table to find the true percentage of Absolute Alcohol** *in a liquid of any temperature from the observed percentage indicated by the Glass Hydrometer at the same temperature.*

True per ct. of Alcohol by Volume.	Observed per cent. indicated by the Glass Hydrometer.										
	30°	35°	40°	45°	50°	55°	65°	70°	75°	80°	85°
0	—0.2	—0.4	—0.4	—0.5	—0.4	—0.2	+0.2	+0.6	+1.0	+1.4	+1.9
5	+4.6	+4.5	+4.5	+4.5	+4.6	+4.8	5.3	5.8	6.2	6.7	7.3
10	9.1	9.0	9.1	9.2	9.3	9.7	10.4	11.0	11.6	12.3	13.0
15	13.0	13.1	13.3	13.6	14.1	14.5	15.6	16.3	17.1	18.0	19.0
20	16.5	16.9	17.4	17.9	18.5	19.2	20.8	21.8	22.9	23.9	25.0
25	19.8	20.5	21.3	22.2	23.0	24.1	25.9	27.1	28.3	29.5	30.7
30	23.3	24.3	25.5	26.5	27.6	28.8	31.2	32.3	33.5	34.6	35.9
35	27.7	28.9	30.2	31.4	32.6	33.8	36.3	37.5	38.6	39.7	40.9
40	32.5	33.8	35.1	36.5	37.7	38.9	41.2	42.4	43.5	44.6	45.8
45	37.8	39.1	40.3	41.5	42.7	43.8	46.2	47.3	48.5	49.6	50.8
50	43.1	44.2	45.4	46.6	47.7	48.9	51.1	52.2	53.4	54.5	55.6
55	48.3	49.4	50.5	51.6	52.8	53.9	56.1	57.2	58.3	59.4	60.5
60	53.4	54.5	55.6	56.7	57.8	58.9	61.1	62.2	63.3	64.4	65.5
65	58.4	59.5	60.6	61.7	62.8	63.9	66.0	67.1	68.2	69.3	70.4
70	63.5	64.6	65.7	66.8	67.9	69.0	71.0	72.1	73.2	74.3	75.4
75	68.6	69.7	70.7	71.8	72·9	74.0	76.0	77.1	78.2	79.2	80.3
80	73.7	74.8	75.8	76.9	78.0	79.0	81.0	82.1	83.1	84.1	85.2
85	78.8	79.8	80.9	81.9	83.0	84.0	86.0	87.0	88.0	89.0	90.0
90	84.0	85.1	86.1	87.1	88.1	89.1	91.0	91.9	92.8	93.7	94.6

Thus, if the Hydrometer indicated 59.4 per cent. in a liquid at 80° Fah., the table in No. 57 would give its true percentage (richness) to 55 per cent.; that is, 100 volumes of the liquid at 80° contains 55 volumes of alcohol. Tralles' Hydrometer gives the *per cent.* by volume only. If it be desired to know the *per cent.* by *weight,* it may be ascertained from the *percentage* in volume of the liquid at 60° Fah. by table in No. 57.

57. Table of Comparison *between the per cent. of Alcohol by volume at 60° (Tralles') and per cent. by weight.*

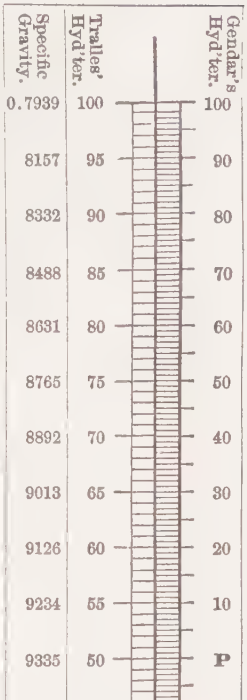
Per Cent. by Vol	Per Cent. by Weight.	Per Cent. by Vol	Per Cent. by Weight.	Per Cent. by Weight.	Per Cent. by Volume.	Per Cent. by Weight.	Per Cent. by Volume.
0	0.	55	47.29	0	0.	55	63.97
5	4.00	60	52.20	5	6.25	60	68.97
10	8.05	65	57.25	10	12.42	65	73.79
15	12.15	70	62.51	15	18.52	70	78.40
20	16.28	75	67.93	20	24.57	75	82.80
25	20.46	80	73.59	25	30.55	80	86.97
30	24.69	85	79.50	30	36.45	85	90.88
35	28.99	90	85.75	35	42.25	90	94.46
40	33.39	95	92.46	40	47.92	95	97.61
45	37.90	100	100.00	45	53.43	100	100.00
50	42.52			50	58,79		

58. Gendar's Hydrometer. Annexed we give a comparative view of the scales of Tralles and Gendar, the former used by the revenue officers of the United States for *imported liquors,* and indicating the per cent. by volume of alcohol in spirituous liquors, and the latter used throughout the whole country for *domestic liquors,* determining the per cent. above and below *proof.*

This is inserted for the convenient comparison of the American standards. Tables of other areometers reduced to specific gravity will be found in Nos. 6155, &c.

The first column of the table exhibits the specific gravities at 60° Fah., for *mixtures* of pure alcohol and water;—taking water at the temperature of its greatest density, about 39.5° Fah., as 1.0000, and, therefore, having at 60° Fah. a specific gravity of 0.9991. Of the above mixtures, each 100 gallons or measures contain the number of gallons or measures of alcohol indicated in the second column (Tralles' hydrometer scale) if measured at 60° Fah.

In the Tralles' hydrometer scale there is no reference to proof of any denomination; and in that of Gendar's there is but one proof, marked P. on the hydrometer; the others, such as 2d, 3d and 4th proofs, were, at all times, incorrect and deceptive. The National Tax Law, of August 1st, 1862, says that "the term proof shall be construed, and is hereby declared to mean that proof of a liquor which corresponds to 50 degrees of Tralles' hydrometer at the temperature of 60 degrees Fah." Proof spirit is, therefore, by law, of the alcoholic strength of 50 per cent. by volume, having a specific gravity of 0.9335, or a mixture of equal quantities of absolute alcohol at the specific gravity of 0.793, and distilled water at 60° Fah. In other words, proof spirit is one-half pure water and half absolute alcohol.



To ascertain what strength any liquor above proof by the Gendar hydrometer would be by the Tralles hydrometer, add 100 to the given proof if above proof, or deduct, if below proof, from 100 on the Gendar scale, and divide by 2. Say a liquor is at 40 above P. on the Gendar scale, you then add 100, making 140, and divide by 2, which will show 70 on the Tralles' scale. If below P. deduct the proof from 100 and divide the remainder by 2. Say a liquor is 35 below P., consequently you have a remainder of 65, and divide the 65 by 2, which will show 32½ on Tralles' scale. Having ascertained the degree of strength of any liquor by volume on Tralles' scale above 50 (which is proof), multiply the degrees by 2, and cut off the two right hand figures, and it will show the degrees above proof on Gendar's scale. Thus we will suppose the spirit to show 70 per cent. strength on Tralles' scale. We therefore multiply 70 by 2, which gives us 140; we now cut off the two right hand figures, thus, 1.40, and find that the liquor is 40 above proof on Gendar's scale.

Or suppose a liquor is below 50 on Tralles' scale (which is below proof). To find what degree it is below on Gendar's scale, multiply the degrees on Tralles' scale by 2 and add a number sufficient to make 100; the number required to be added will show the degree below proof.

59. Tralles' Table of Percentage of Alcohol. When the temperature of the spirit is 60° Fah., the first column of the table on page 26 gives at *once* the percentage of alcohol by *measure; when the temperature is below* 60° an addition must be made of 1 measure per cent. for every 5 degrees of the thermometer; and when above 60° a like quantity must be deducted. This correction will amount to the fraction ⅕ or the decimal 2 for every single degree, and is very easily made. *If the specific gravity* sought cannot be found exactly in the table, the *difference* between it and the next greater specific gravity in the table must be taken, which will give the numerator of a fraction, having for its denominator the number found in the *third* column against the next greater number just employed. This fraction, added to the percentage of alcohol in the first column of the table against the said specific gravity, will give the true percentage sought. Thus, if the specific gravity of a spirituous liquor is .9605, what is its alcoholic content? Here .9605 is not in the table, but the next greater number is .9609; the former must therefore be deducted from the latter, and the difference (4) put as the numerator of the fraction, having for its denominator the number (13) in the column of differences against .9609. The fraction $\frac{4}{13}$ so found, added to the percentage against .9609 in the first column, gives $33\frac{4}{13}$ as the true percentage of alcohol in the given sample

Tralles' Table exhibiting the percentage, by volume, of Alcohol, corresponding to any given specific gravity.

Alcohol in 100 Measures of Spirit.	Specific Gravity at 60° F.	Difference of Specific Gravity.	Alcohol in 100 Measures of Spirit.	Specific Gravity at 60° F.	Difference of Specific Gravity.	Alcohol in 100 Measures of Spirit.	Specific Gravity at 60° F.	Difference of Specific Gravity.
Pure water	.9919	00	34	.9596	13	68	.8941	24
1	.9976	15	35	.9583	13	69	.8917	24
2	.9961	15	36	.9570	13	70	.8892	25
3	.9947	14	37	.9556	14	71	.8867	25
4	.9933	14	38	.9541	15	72	.8842	25
5	.9919	14	39	.9526	15	73	.8817	25
6	.9906	13	40	.9510	16	74	.8791	26
7	.9893	13	41	.9494	16	75	.8765	26
8	.9881	12	42	.9478	16	76	.8739	26
9	.9869	12	43	.9461	17	77	.8712	27
10	.9857	12	44	.9444	17	78	.8685	27
11	.9845	12	45	.9427	17	79	.8658	27
12	.9834	11	46	.9409	18	80	.8631	27
13	.9823	11	47	.9391	18	81	.8603	28
14	.9812	11	48	.9373	18	82	.8575	28
15	.9802	10	49	.9354	19	83	.8547	28
16	.9791	11	50	.9335	19	84	.8518	29
17	.9781	10	51	.9315	20	85	.8488	30
18	.9771	10	52	.9295	20	86	.8458	30
19	.9761	10	53	.9275	20	87	.8428	30
20	.9751	10	54	.9254	21	88	.8397	31
21	.9741	10	55	.9234	20	89	.8365	32
22	.9731	10	56	.9213	21	90	.8332	33
23	.9720	11	57	.9192	21	91	.8299	33
24	.9710	10	58	.9170	22	92	.8265	34
25	.9700	10	59	.9148	22	93	.8230	35
26	.9689	11	60	.9126	22	94	.8194	36
27	.9679	10	61	.9104	22	95	.8157	37
28	.9668	11	62	.9082	22	96	.8118	39
29	.9657	11	63	.9059	23	97	.8077	41
30	.9646	11	64	.9036	23	98	.8034	43
31	.9634	12	65	.9013	23	99	.7988	46
32	.9622	12	66	.8989	24	Pure Alcohol	.7939	49
33	.9609	13	67	.8965	24			

60. Table for reducing the strength of Alcohol. The following Table given by Booth, shows the quantity of water that must be added to alcohol of a given strength, in order to produce an alcohol of inferior strength.

The upper horizontal column contains the percentage of strength of the stronger alcohol to be diluted; the vertical columns below, denote the volumes of water which must be added to 100 volumes of it, in order to produce a spirit of the strength indicated in the left hand column.

Desired strength in per cent.	90	85	80	75	70	65	60	55	50
85	6.56								
80	13.79	6.83							
75	21.89	14.48	7.20						
70	31.05	23.14	15.35	7.64					
65	41.53	33.03	24.66	16.37	8.15				
60	53.65	44.48	35.44	26.47	17.58	8.56			
55	67.87	57.90	48.07	38.32	28.63	19.02	9.47		
50	84.71	73.90	63.04	52.43	41.73	31.25	20.47	10.35	
45	105.34	93.30	81.38	69.54	57.78	46.09	34.46	22.90	11.41
40	130.80	117.34	104.01	90.76	77.58	64.48	51.43	38.46	25.55
35	163.28	148.01	132.88	117.82	102.84	87.93	73.08	58.31	43.59
30	206.22	188.57	171.05	153.61	136.04	118.94	101.71	84.54	67.45
25	266.12	245·15	224.30	203.53	182.83	162.21	141.65	121.16	100.73
20	355.80	329.84	304.01	278.26	252.58	226.98	201.43	175.96	150.55
15	505.27	471.	436.85	402.81	368.83	334.91	301.07	267.29	233.64
10	804.54	753.65	702.89	752.21	601.60	551.06	500.59	450.19	399.85

Illustration. If we have alcohol of 70 per cent. strength, and desire to reduce its strength to 40 per cent.—we look for 40 in the left-hand column, and the figures on a line with it in the column headed 70, we find to be 77.58. This shows that we must add 77.58, or a trifle over 77½ gallons of water to 100 gallons of our 70 per cent. alcohol, to produce a spirit of 40 per cent. strength.

61. Baumé's Hydrometer for Liquids Lighter than Water. In Baumé's hydrometer for liquids lighter than water, the instrument is poised, so that the 0 of the scale is at the bottom of the stem, when it is floating in a solution of 1 ounce common salt in 9 ounces water, and the depth to which it sinks in distilled water shows the 10th degree; the space between these fixed points being equally divided.

62. Table showing the Specific Gravity *corresponding with the several degrees of Baumé's Hydrometer for liquids lighter than water.*

Degrees Baumé	Specific Gravity.	Degrees Baumé	Specific Gravity.
60°	.745	34°	.859
59	.749	33	.864
58	.753	32	.869
57	.757	31	.874
56	.760	30	.880
55	.764	29	.885
54	.768	28	.890
53	.773	27	.896
52	.777	26	.901
51	.781	25	.907
50	.785	24	.913
49	.789	23	.918
48	.794	22	.924
47	.798	21	.930
46	.802	20	.936
45	.807	19	.942
44	.811	18	.948
43	.816	17	.954
42	.820	16	.960
41	.825	15	.967
40	.830	14	.973
39	.834	13	.980
38	.839	12	.986
37	.844	11	.993
36	.849	10	1.000
35	.854		

63. Baumé's Hydrometer for Liquids Heavier than Water. In the hydrometer for liquids heavier than water, the position of the fixed points is reversed; for the 0 is at the top of the stem, and denotes the level to which the hydrometer sinks in distilled water: the 10th degree is lower down, and shows the level to which it sinks in the saline solution, and the graduation is continued downwards.

64. Baumé's Areometer, or Saccharometer for Liquids Heavier than Water. This instrument is generally in use in this country and in France, when it is necessary to ascertain the strength or density of a liquid heavier than water. In England, Twaddel's hydrometer is mostly employed for the purpose. Baumé's instrument is principally used by confectioners to test the density of syrup; also by brewers and distillers to discover the quantity of saccharine matter in wort; and by soap manufacturers and dyers to prove the strength of their lyes and dyeing materials. This variety of Baumé's hydrometer is usually called a saccharometer, and when plunged in pure water at 58° Fahr., marks 0 upon its scale; in a solution containing 15 per cent. of common salt and 85 of water by weight, it marks 15°; so that each degree on the scale is meant to indicate a density corresponding to the percentage of the salt.

The temperature at which Baumé's hydrometer was originally adjusted was 54½° Fahr.; it is now commonly adjusted to 58° or 60° Fahr.; hence arise the discrepancies observable in the published tables of the "correspondence between degrees of Baumé's and real specific gravities."

65. Table showing the Specific Gravity *corresponding with the several degrees of Baumé's Hydrometer for liquids heavier than water.*

Degrees of Baumé.	Specific Gravity.	Degrees of Baumé.	Specific Gravity.
0	1000	39	1372
1	1007	40	1384
2	1014	41	1398
3	1022	42	1412
4	1029	43	1426
5	1036	44	1440
6	1044	45	1454
7	1052	46	1470
8	1060	47	1485
9	1067	48	1501
10	1075	49	1516
11	1083	50	1532
12	1091	51	1549
13	1100	52	1566
14	1108	53	1583
15	1116	54	1601
16	1125	55	1618
17	1134	56	1637
18	1143	57	1656
19	1152	58	1676
20	1161	59	1695
21	1171	60	1715
22	1180	61	1736
23	1190	62	1758
24	1199	63	1779
25	1210	64	1801
26	1221	65	1823
27	1231	66	1847
28	1242	67	1872
29	1252	68	1897
30	1261	69	1921
31	1275	70	1946
32	1286	71	1974
33	1298	72	2002
34	1309	73	2031
35	1321	74	2059
36	1334	75	2087
37	1346	76	2116
38	1359		

66. To Convert Degrees Baumé into Specific Gravity. I. For liquids heavier than water.—Subtract the degree of Baumé from 145, and divide into 145; the quotient is the specific gravity.

II. For liquids lighter than water.—Add the degree of Baumé to 130, and divide it into 140; the quotient is the specific gravity.

67. To Convert Specific Gravity into Degrees Baumé. I. For liquids heavier than water.—Divide the specific gravity into

145, and subtract from 145; the remainder is the degree of Baumé.

II. For liquids lighter than water.—Divide the specific gravity into 140 and subtract 130 from the quotient; the remainder will be the degree of Baumé.

68. Twaddell's Hydrometer. This Hydrometer is much used in the bleaching and dyeing establishments in Scotland, and some parts of England. According to this scale 0 is equal to 1000, or the specific gravity of distilled water, and every additional 5 degrees of specific gravity adds 1 degree to Twaddell's scale. So that, in order to find the specific gravity corresponding to any degree of Twaddell's scale, multiply the degree by 5 and add 1000; thus, if this hydrometer shows 30°, 30 multiplied by 5 gives 150, and 1000 added makes 1150, the specific gravity. To find the degree of Twaddell corresponding to any specific gravity, deduct 1000 from the specific gravity, and divide the remainder by 5; the quotient will be the corresponding degree of Twaddell.

Thus, if it be required to find the degree of Twaddell corresponding to 1150 specific gravity, deduct 1000 from 1150, and divide the remainder, 150, by 5, and the quotient, 30, gives the degrees of Twaddell required. In this way the corresponding degrees of Twaddell and Baumé can easily be found. Thus, 31 degrees of Baumé are equivalent to a specific gravity of 1275; and this, according to the above rule, will give 55 degrees Twaddell. By reversing this process, Twaddell can as readily be reduced to Baumé.

Acetimetry. The art of determining the strength of acetic acid and vinegar. Several methods are employed for the purpose, based on—the quantity of acid required for saturation;—the specific gravity after the liquid has been neutralized with hydrate of lime;—and the simple specific gravity. In all these methods, account should be taken of any mineral acid which may have been added, as is common with vinegars, to impart artificial strength.

70. To find the Comparative Weights of Dry and Glacial Acetic Acid. As both *dry* and *glacial* (or *hydrated*) acetic acid are referred to in many places, in speaking of strengths, it may be convenient to know that 51 parts of *dry* acetic acid are equal to 60 parts of *glacial.* (*See No.* 81.) Hence the weight of *glacial* acid multiplied by .8512, gives the weight of *dry* acid; and the weight of *dry* acid, multiplied by 1.1748 gives a very close approximation to the weight of *glacial* acid.

71. Precautions in Testing Acids. It is essential to success, in testing acetic or other acids by saturation, to hit the *exact* point of neutralization. It will be found greatly to simplify matters to tint with litmus (*see No.* 78) either the sample under examination, or the test liquid; but when litmus is used, it is advisable to apply a gentle heat to the test tube when saturation appears *nearly* reached; the heat will expel from the liquor the free carbonic acid, which itself has the property of reddening litmus. A glass or wooden rod should be used for stirring, and the test liquid added drop by drop.

72. To find the strength of Acetic Acid by its Saturating Power. Dissolve 196½ grains pure crystallized bicarbonate of potassa in a little water; add to the solution sufficient water to make up exactly 1000 minims, or the 100 divisions of an *acidimeter,* a graduated glass tube of 100 divisions, each division representing 10 minims. (*See illustrations, No.* 82.) A solution is thus formed, which, when added by degrees to 100 minims of the acetic acid or vinegar under examination, until the latter is exactly saturated, indicates the exact amount of acid present in the sample. Each minim of the alkaline solution thus employed represents 1 per cent. of dry acetic acid. The test liquid must be added a drop at a time to avoid the risk of loss by excessive effervescence.

73. To find the strength of strong Acetic Acid. If *strong* acetic acid be under inspection, it will be found convenient, previously to testing it, to dilute it with from 2 to 8 times its weight of distilled water, according to its degree of concentration. Dilute acid and vinegar require no further dilution.

Instead of 196½ grains *crystallized* bicarbonate of potassa, may be used either 135 grains *dry* (*see No.* 12) carbonate of potassa, 281 grains crystallized carbonate of soda, or 104 grains *dry* carbonate of soda. (*See No.* 80.)

By using 98¼ grains (half the quantity) of the bicarbonate of potassa, we obtain a still more delicate test liquid; as each minim used for saturating a sample of acid will represent only ½ of 1 per cent. of dry acid.

74. To find the strength of Acetic Acid by Saturation without an Acidimeter. The foregoing method can also be applied to test by weight, instead of by an acidimeter; 1000 grains of the test liquid are used in testing 100 grains of acid. Every grain of the test liquid necessary to produce saturation indicates $\frac{1}{10}$ grain of dry acid, and every ten grains are equal to 1 per cent. Schuster's alkalimeter is a convenient instrument for this process. (*See No.* 82.) 1000 grains of the test liquid are introduced into the alkalimeter, and the whole weighed; the weight of the bottle and solution, after using such portion of its contents as is required for testing, deducted from the previous weight of the whole, gives the exact quantity in grains of the solution consumed; this, divided by 10, gives the percentage of acid in the sample tested. This method admits of great accuracy.

75. Practical test of the strength of Acetic Acid. A less accurate, but more convenient method for practical purposes, is as follows:—To 100 or 1000 parts (or grains) of a sample under inspection, add cautiously from a weighed quantity of powdered pure *dry* bicarbonate of potassa, sufficient to produce exact neutralization; carefully re-weigh the bicarbonate unconsumed. Double the loss in grains will indicate the percentage of acid in the liquid tested.

76. Ure's Test of the strength of Acetic Acid. Ure's test gives very accurate results, if the ammonia employed is of the proper specific gravity. To 100 grains of a sample, very slightly reddened with neutral (blue) tincture of litmus, add liquor of ammonia of specific gravity .992 from an acidimeter (*see No.* 82) until perfect neutralization is effected, indicated by the original blue color of the litmus being restored. The number of acidimetric divisions of ammonia expended, multiplied by 51 (for *dry*) or by 60 (for *glacial*) and the product divided by 100, will give, respectively, the percentage of *dry* or *glacial* acid in the sample. Thus:—if a sample of vinegar takes 10 acidimetric divisions of ammonia to neutralize it, then 10 multiplied by 51, and divided by 100, gives 5.10, equivalent to $5\frac{1}{10}$ per cent. of *dry* acid:—or, 10 multiplied by 60 and divided by 100, gives 6 per cent. of *glacial* or *hydrated* acid in the sample.

77. Ure's Test, by Grains, of the strength of Acetic Acid. The same strength of ammonia is to be used in the acidimeter as in the preceding test, and the number of grain-measures of ammonia employed for a multiplier instead of acidimetric divisions. The only difference is, that the product in each case must be divided by 1000 instead of 100, to give the percentage of acid.

Acidimetry. The estimation of the quantity of an acid contained in any given sample.

The methods used are founded chiefly on the capacity of acids to saturate or neutralize alkaline bases; and, in some of the liquid acids, on specific gravity.

The accuracy of the tests, when saturation is resorted to, depends greatly on the *exact* point of neutralization, as already remarked under the head of *Acetimetry.* The proper point is arrived at when the liquid, after being slightly heated, ceases to redden litmus, or does not alter the color of turmeric paper (*see Test Papers*); if it turns the latter brown, too much test-liquid has been added, and the operation becomes useless. A good method is to tint either the acid sample or the test-liquid with a few drops of litmus (*see No.* 71), when the reddish shade will gradually deepen to purple as the point of saturation is approached, and the blue color be restored as soon as that point is reached.

79. To test the strength of an Acid by Saturation. Place in a test tube 100 grains of the acid to be examined; if the acid be liquid, dilute it—if solid, dissolve it—in 6 or 8 times its weight of distilled water. Then *exactly* neutralize it with an alkali added drop by drop. The known quantity of alkali consumed for this purpose represents an equivalent quantity of the actual acid contained in the test tube. The common practice is to dissolve 1 equivalent (*see No.* 80) of an alkaline test in water, and to make up the solution to 1000 grains (100 acidimetric divisions). The equivalent value of the test-liquid is then 100; hence, the quantity of the sample tested will bear the same proportion to the equivalent number (*see No.* 81) of the acid under examination, that the acidimetric divisions of the test-liquid consumed, bear to the percentage of acid sought. For example: Suppose 100 grains of a sample of sulphuric acid require 60 acidimetric divisions (600 grains) of the test-liquid to neutralize them; what is the percentage of the acid? The equivalent of dry sulphuric acid is 40 (*see No.* 81); therefore by the rule of proportion, since 100 : 40 : : 60 : 24, the sample contains 24 per cent. of dry sulphuric acid.

In this method the choice of the re-agent must depend on the operator. Some prefer the ammonia test (*see No.* 76), which is very convenient and easily applied; others give a preference to bicarbonates or carbonates of potassa or soda. Whichever be adopted, it must be perfectly pure. A test solution, once carefully prepared of the proper strength, may be kept unharmed for any length of time in a stoppered bottle, and will be always ready for application.

80. Table of Equivalents of Alkalis.

	GRAINS.
Pure ammonia	17
Dry carbonate of soda	53
Crystallized carbonate of soda	143
Crystallized bicarbonate of soda	84
Dry carbonate of potassa	69
Crystallized carbonate of potassa	87
Crystallized bicarbonate of potassa	100
Pure or caustic soda	31
Pure or caustic potash	47
Sesquicarbonate of soda	85
Neutral carbonate of ammonia	43½
Sesquicarbonate of ammonia	59
Bicarbonate of ammonia	79

1000 grain measures of pure water of ammonia of specific gravity .992, contain 17 grains or 1 equivalent of pure gaseous ammonia.

It is understood that all crystals must be perfectly free from attached water, but not in the least effloresced.

81. Table of Equivalents of Acids. This table is based on the foregoing table of alkalis; so that, for instance, 1 equivalent (17 grains) of pure ammonia will exactly neutralize 1 equivalent (22 grains) dry carbonic acid, &c.

	GRAINS.
Anhydrous acetic acid	51
Hydrated or crystallized acetic acid	60
Dry benzoic acid	113
Crystallized benzoic acid	122
Dry boracic acid	35
Crystallized boracic acid	62
Dry carbonic acid	22
Dry citric acid	58
Crystallized citric acid	67
Dry hydrochloric acid	36½
Liquid hydrochloric acid (sp.gr.1.16)	109
Dry malic acid	58
Dry nitric acid	54
Liquid nitric acid (sp. gr. 1.5)	67
" " " (sp. gr.1.42)	90
Dry oxalic acid	36
Crystallized oxalic acid	63
Dry sulphuric acid	40
Liquid sulphuric acid (sp. gr. 1.845	49
Dry tartaric acid	66
Crystallized tartaric acid	75

82. Acidimeter. An acidimeter is a glass tube, graduated with 100 divisions, each division representing 10 grains of distilled water, termed grain measures. The acidimeter is used for testing acids and alkalis, and is usually furnished with a lip for convenience in pouring by drops. Where great delicacy is required in pouring or dropping, various appliances are resorted to, by which the outward flow can be instantly arrested, merely by placing the finger or thumb on an orifice arranged for the ingress of air. In the illustrations, *c* denotes the place of egress for the contained liquid; *b*, the orifice for the ingress of air, to be stopped by the finger or thumb; in Fig. 2, both orifices are in a hollow movable stopper; in Fig. 4, the air-hole only is in the stopper, *a*.

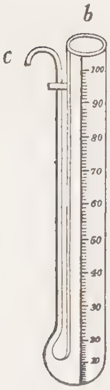


Fig. 1.

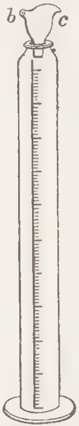


Fig. 2.

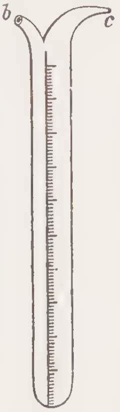


Fig. 3.

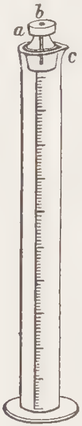


Fig. 4.

Fig. 1 represents Gay Lussac's Pouret.

Fig. 2, Normandy's modification of Schuster's Alkalimeter.

Fig. 3, Birck's Alkalimeter.

Fig. 4 is a simple acidimeter, with a stopper fitted to it, having a groove to correspond with the lip, and a vent-hole drilled through it to admit the air.

These modifications of the simple acidimeter are employed to allow of the test-liquid being added a single drop at a time, which is absolutely necessary during the first part of the process, to prevent undue effervescence, and consequent danger of loss of the liquid; and in the latter part it is equally indispensable in order to attain exact saturation. They dispense with the use of a separate *pipette*, being, in fact, acidimeters and pipettes combined.

Alkalimetry.

The method of estimating the strength of alkalis. The processes used are the same as in *acidimetry;* only that the unknown quantity sought is an alkali, and the test applied is an acid. The test acid is 1 equivalent (40 grains, *see No.* 81) of sulphuric acid sp. gr. 1.032 at 60° Fahr. inserted in an acidimeter (*see No.* 82) and made up with distilled water to 100 acidimetric divisions.

84. To find the strength of an Alkali. Place 100 grains of the alkali in a tube, and agitate it with about ½ ounce hot water. When settled, pour off the clear into a vessel for trial. Repeat this process until nothing soluble remains in the test tube, shown by the last washing *not* affecting the color of turmeric paper. Care must be taken not to waste the smallest portion of the liquid, as it would render the results inaccurate.

Next, *exactly* neutralize the alkaline solution by adding sufficient of the test acid drop by drop. If the saturation is complete, it will neither turn litmus paper red, nor turmeric paper brown. (*See No.* 78.) The weight of alkali tested, bears the same relation to its *equivalent weight* (*see No.* 80), that the acidimetric divisions of acid used, do to the percentage of alkali sought.

Thus:—If we test 100 grains of potash and find it requires 35 acidimetric divisions of test acid to saturate it, we refer to table No. 80, and find that the equivalent of pure potash is 47 grains. Then 100 : 47 : : 35 : 16.45.

That is, the sample of potash under examination contains nearly 16½ per cent. of *pure* potash. (*See No.* 587.)

The Thermometer.

In Fahrenheit's Thermometer, which is universally employed in this country and Great Britain, the freezing point of water is placed at 32°, and the boiling point at 212° and the number of intervening degrees is 180.

The Centigrade thermometer, which has long been used in Sweden under the name of Celsius' thermometer, and is now employed on the continent of Europe generally, marks the freezing point at *Zero* or 0°, and the boiling point at 100°.

In Reaumur's thermometer, used in France before the revolution, the freezing point is *Zero*, and the boiling point 80°.

Degrees below zero are distinguished by prefixing the minus sign, thus —; so that — 17° Fahr. represent a temperature of 17° lower than zero, equivalent to 49 degrees below freezing point.

86. To Convert degrees of Centigrade into degrees of Fahrenheit. Multiply the degrees of Centigrade by 9, and divide the result by 5:—then add 32.

Thus: to find the degrees of Fahrenheit equivalent to 30 degrees of Centigrade.

30 degrees Centigrade.
Multiplied by 9
Divided by 5)270
54
Add 32
Answer, 86 degrees Fahrenheit.

87. To reduce degrees of Fahrenheit to the corresponding degrees of Centigrade. Reverse the above process—First deduct 32 from the degrees of Fahrenheit, then multiply the difference by 5, and lastly divide the result by 9.

Thus, 86 degrees Fahrenheit.
Deduct 32
54
Multiplied by 5
Divided by 9)270
Answer, 30 degrees Centigrade.

88. To Reduce degrees of Reaumur to the corresponding degrees of Fahrenheit. Multiply the degrees of Reaumur by 9, divide the result by 4, and then add 32.

Thus, 24° Reaumur.
Multiplied by 9
Divided by 4)216
54
Add 32
Answer, 86° Fahrenheit.

89. To reduce degrees of Fahrenheit to corresponding degrees of Reaumur. Reverse the above process.

90. To reduce degrees of Reaumur to Centigrade. Add to the degrees of Reaumur their one-fourth part.

Thus, 40° Reaumur.
Add one-fourth, 10
Answer 50° Centigrade.

91. To reduce degrees of Centigrade to Reaumur. Deduct one-fifth part.

Thus, 50° centigrade
Deduct one-fifth 10
Answer, 40° Reaumur.

92. Table of corresponding degrees of Fahrenheit, Reaumur and the Centigrade.

	Fahrenheit.	Reaumur.	Centigrade.
Boiling.	212	80	100
	203	76	95
	194	72	90
	185	68	85
	176	64	80
	167	60	75
	158	56	70
	149	52	65
	140	48	60
	131	44	55
	122	40	50
	113	36	45
	104	32	40
	95	28	35
	86	24	30
	77	20	25
	68	16	20
	59	12	15
	50	8	10
	41	4	5
Freezing.	32	0	0
	23	—4	—5
	14	—8	—10
	5	—12	—15
	—4	—16	—20
	—13	—20	—25
	—22	—24	—30
	—31	—28	—35
	—40	—32	—40

All intermediate degrees can be obtained by the preceding rules.

The Art of Dyeing.

The art of fixing coloring matters uniformly and permanently in the fibres of wool, silk, linen, cotton, and other substances. Dyeing is a chemical process, and the mode of its performance depends upon the substance operated on. Thus it is found that the process by which wool is dyed black, would only impart a rusty brown to linen. *Wool* unites with almost all coloring matters with great facility, *silk* in the next degree, *cotton* less easily than silk, and *linen* with even more difficulty. Preparatory to the operation of dyeing, each of these substances undergoes a species of preparation to free the fibres from adhering foreign matter, as dirt, grease, &c, which would prevent the absorption of the aqueous fluid to be afterwards applied, as well as impair the brilliancy of the dye. *Wool* is cleaned or scoured by means of a weak alkaline lye, soap and water, or putrid urine; the latter being very generally used for this purpose. *Silk* is cleaned from the natural varnish that covers it, by boiling with white soap and water. *Cotton* and *linen* are cleaned with alkaline lyes of more or less density. The substances so prepared are ready to undergo the various operations of dyeing.

Among the various coloring materials employed by dyers, some impart their tints to different substances by simple immersion in their infusions or decoctions, and have hence been called "*substantive colors;*" but by far the greater number only impart a fugitive dye, unless the fibres of the stuff have been previously filled with some substance which has a strong affinity for the latter on the one hand, and the coloring material on the other. The substances applied with this intention are called "*Mordants,*" and generally exercise the double property of "*fixing*" and "*striking*" the color. Thus, if cotton goods be dyed with a decoction of madder, it will only receive a fugitive and dirty red tinge, but if it be first run through a solution of acetate of alumina, dried at a high temperature, washed, and then run through a madder bath, it will come out a permanent and lively red. The principal mordants are the acetates of iron and alumina, sulphate of iron, alum, and some other chemical salts. A perfect knowledge of the effect of mordants on different coloring substances is of paramount importance to the dyer.

After having received the proper mordants, the goods are dried and rinsed, after which they are passed for a shorter or longer time through an infusion, decoction, or solution of the dyeing materials, which constitute the "*dye-bath*"; they are again dried and rinsed. In many cases, the immersion in the dye-bath is repeated, either with the same materials or with others to vary or modify the color. After the substances have been properly dyed, they are subjected to a thorough rinsing or washing in soft water, until the latter runs off uncolored.

94. Dye Woods, &c. Decoctions of the different woods are prepared for general use in the dye house as they are required. If the wood be in the chipped state, it must be boiled for an hour, in the proportion of 1 pound of wood to 1 gallon of water; a second boiling is generally given with new water, and the liquor obtained used instead of water with more new wood. This second liquor is not good for dyeing alone, but when employed instead of water for new wood, ¾ pound of new wood is sufficient. The second liquor may, however, be used as an auxiliary in the dyeing of compound colors, such as browns, drabs and fawns. If the wood be ground the same quantity is taken—namely, 1 pound for each gallon of the decoction required, and is prepared as follows:—on a piece of coarse cloth stretched upon a frame, or laid into a basket, put the ground wood, and place it over a vessel, then pour boiling water over the wood until the liquor that runs through is nearly colorless. Barwood and Camwood are always used in the ground state, the wood being put into the boiler along with the goods; no decoctions of these woods are made. Decoctions of bark and weld are often formed by putting them into a coarse canvas bag, and then suspending it in boiling water.

The coloring principle of archil is highly soluble in hot water, and is useful in combination with other dyeing materials; but used alone, does not impart a permanent color.

95. **To prepare Annotto.** Into 2 gallons of water put 1 pound of Annotto, 4 ounces of pearlash, and 2 ounces of soft soap, and apply heat, stirring until the whole is dissolved. When convenient it is best to boil the solution.

96. **To prepare Catechu.** To 7 or 8 gallons of water put 1 pound of catechu, and boil till it is all dissolved; then add 2 ounces of sulphate of copper, stir, and it is ready for use. Nitrate of Copper may also be used, taking 1 wine-glassful of the solution made according to the next receipt.

97. **To make Nitrate of Copper Solution.** To 1 part by measure nitric acid, and 2 parts water, add metallic copper so long as the acid will dissolve it, then bottle the solution for use.

98. **To make Sulphate of Indigo.** Into 5 pounds of the most concentrated sulphuric acid, stir in by degrees 1 pound of the best indigo, finely ground; expose this mixture to a heat of about 160° Fahr. for 10 or 12 hours, stirring it occasionally; a little rubbed upon a window-pane should assume a purple-blue color.

99. **To make Indigo Extract.** This is prepared by proceeding exactly as stated for sulphate of indigo and then diluted with about 4 gallons hot water, and the whole put upon a thick woolen filter, over a large vessel, and hot water poured upon the filter, until it passes through nearly colorless; the blackish matter retained upon the filter is thrown away, and the filtered solution is transferred to a leaden vessel, and evaporated to about 3 gallons, to which is added about 4 pounds chloride of sodium (table salt) and well stirred; the whole is again put upon a wooden filter and allowed to drain. The extract remains as a thin pasty mass upon the filter, and is ready for use.

100. **To make Red Liquor.** Into 1 gallon hot water place 2 pounds alum; dissolve, in a separate vessel, 2 pounds acetate of lead in 1 gallon water; in a third vessel dissolve ½ pound crystallized soda; mix all the solutions together and stir well for some time, then allow to stand over night; decant the clear solution which is ready for use.

101. **To make Caustic Potash.** To 3 gallons water add 2 pounds either black or pearl ashes, and boil; when seething add newly-slaked lime, until a small quantity taken out does not effervesce when an acid is added to it. To test this, take a tumbler half filled with cold water, put a table-spoonful of the boiling lye into the tumbler, and add a few drops sulphuric acid; if the acid were added to the hot lye, it would spurt up and endanger the operator. When the addition of acid causes no effervescence, the boiling and adding of lime is stopped, and the whole allowed to settle; then remove the clear liquid into a vessel having a cover, to prevent it from taking carbonic acid from the air. This serves as a stock for general use. The lime sediment remaining may have some hot water added, which will give a strong lye, and may be used for first boils for yarn or heavy cloth.

102. **To make Caustic Soda.** For every gallon water add 1 pound soda ash, or 2 pounds crystallized soda (washing soda); boil and proceed by adding slaked lime, and testing as for potash; boiling for some time is essential in order to ensure perfect causticity.

103. **To make Lime-water.** Take some well and newly-burned limestone, and pour water over it as long as the stone seems to absorb it, and allow it to stand; if not breaking down freely, sprinkle a litttle more water over it. A small quantity is best done in a vessel, such as an old cask, so that it can be covered with a board or bag. After being slaked, add about 1 pound of it to every 10 gallons cold water, then stir and allow to settle; the clear liquor is what is used for dyeing. This should be made up just previous to using, as lime-water standing attracts carbonic acid from the air, which tends to weaken the solution.

104. **To Make Bleaching Liquor.** Take a quantity of bleaching powder (chloride of lime) and add to it as much water as will make it into a thin cream; take a flat piece of wood, and break all the small pieces by pressing them against the side of the vessel, then add 2 gallons cold water for every pound of powder; stir well, put a cover upon the vessel, and allow the whole to settle. This will form a sort of stock vat for bleaching operations.

105. **To make a Sour.** To every gallon of water add 1 gill of sulphuric acid, stir thoroughly; goods steeped in this should be covered with the liquor, as pieces exposed become dry, which deteriorates the fibre; if left under the liquor the cloth is not hurt by being long in the sour, but on being taken out, every care should be taken to wash out the liquor thoroughly, otherwise the goods will be made tender.

106. **To make Cochineal Liquor or Paste.** Put 8 ounces ground cochineal into a flask and add to it 8 fluid ounces ammonia and 8 ounces water; let the whole simmer together for a few hours, when the liquor is ready for use.

107. Acid Preparations of Tin. The acid preparations of tin used in dyeing are called *spirits,* with a term prefixed to each denoting their particular application, as red spirits, barwood spirits, &c. The tin employed for making these preparations has to undergo a process called *feathering,* and is as follows:—the tin is melted in an iron pot, and then poured from some height into a vessel filled with cold water; this granulates or feathers, the tin. (*See No.* 3319.)

108. Red Spirits are made by mixing together in a stoneware vessel, 3 parts by measure hydrochloric acid, 1 part nitric acid, and 1 part water, and adding to this feathered tin in small quantities at a time, until about 2 ounces tin to the pound of acid used are dissolved. In this operation the temperature should not be allowed to rise. (*See No.* 4124.)

109. Yellow Spirits are prepared in the same way, only substituting sulphuric acid for the nitric acid. This is used for the same purposes as red spirits, with the advantage of the economy of sulphuric over nitric acid.

110. Barwood Spirit is prepared by using 5 measures hydrochloric acid, 1 nitric acid and 1 water, dissolving in this 1 ounce feathered tin for every pound of the whole mixture. 1½ ounces tin may be used if the red dye is required to be very deep.

111. Plumb Spirit is made by using 6 to 7 measures hydrochloric acid to 1 nitric acid and 1 water, dissolving in it 1½ ounces tin for each pound of the acid mixture. This spirit is named from a preparation made with it and a decoction of logwood. A strong solution of logwood is made and allowed to cool, then to each gallon of the solution there is added from 1 to 1½ pints of the spirit; the whole is well stirred and set aside to settle. This preparation has a beautiful violet color, and silk and cotton are dyed of that shade by dipping them into this *plumb liquor* without any previous mordant. The depth of tint will depend on the strength of the solution.

112. Plumb Spirit for Woolen Dyeing. This is prepared by adding tin to nitric acid in which a quantity of chloride of ammonium (sal ammoniac) has been dissolved. Observe, that all these spirit preparations are varied by different operators, some preferring more or less of the two acids, and also of the tin; but the proportions given form good working spirits, and if care be taken in their preparation not to *fire* them, that is, not to allow the temperature to get so high as to convert the tin into a persalt, the operator will not fail in his processes as far as the quality of the spirit is concerned.

113. Tin Spirits. The following are among the best recommended preparations of tin spirits, used for dyeing scarlet:

1 pound nitric acid, 1 pound water; dissolve in this 1½ ounces sal ammoniac, and then add, by degrees, 2 ounces pure tin, beaten into ribbons.

Or: dissolve 1 part sal ammoniac in 8 parts nitric acid at 30° Baumé; add, by degrees, 1 part pure tin; and dilute the solution with one-fourth its weight of water.

Or: 4 parts hydrochloric acid at 17° Baumé, 1 part nitric acid at 30° Baumé; dissolve in this mixture 1 part pure tin.

Or: 8 parts nitric acid, 1 part sal ammoniac or common salt, and 1 part grain tin. This is the common spirit used by dyers.

114. Alum Plumb. Make a strong decoction of logwood, and then add to it 1 pound alum for every pound of logwood used.

115. To Test the Purity of Alum. The usual impurity which renders alum unfit for the uses of the dyer, is the ferro-sulphate of potassa, but if iron be present in any other shape it is equally injurious. Common alum frequently contains ammonia, from urine or the crude sulphate of the gas works having been employed in its manufacture. This may be detected by adding a little quicklime or caustic potassa. Pure alum should form a colorless solution with water, and give a white precipitate with pure potassa soluble in an excess of the latter. It should suffer no change on the addition of tincture of galls, prussiate of potash, or sulphureted hydrogen.

116. Nitrate of Iron is used in the dye-house for various purposes. Its principal use is for dyeing Prussian Blue, and is obtained as follows: Take 4 parts nitric acid and 1 part water in a glass or stoneware vessel; place it in a warm bath, and add clean iron so long as the acid continues to dissolve it with effervescence; take out any iron that remains undissolved, and, after settling for 1 hour, the clear solution is ready for use. The fumes given off during the operation should be guarded against, being deleterious to health and injurious to any metal or vegetal with which they come in contact. This solution should be kept in the dark, as it loses some of its strength by exposure to light.

117. Chloride of Iron is another salt used in the dye-house for dyeing silks and woolens a deep blue, and is preferred, for that purpose, to copperas. It is prepared for use thus: To 4 parts hydrochloric acid add 2 parts water, and apply a gentle heat; then add iron in pieces, or filings, so long as it continues to be dissolved; then pour off the clear liquid into a basin, and evaporate, when greenish colored crystals of chloride of iron will be obtained. This salt crystallizes with difficulty, deliquesces in the air, and should not be exposed. Instead of evaporating and crystallizing, the solution may be put in a bottle and reserved for use.

118. To make Iron Liquor. Into a large cast-iron boiler, or pot, a quantity of iron turnings, hoops or nails, are introduced, and acetic acid—the crude pyroligneous acid from the distillation of wood—is poured in upon them. The strength of the acid is generally of 5° Baumé, or specific gravity 1.035. A temperature of 150° Fahrenheit is maintained till the solution of protoacetate of iron is obtained. During the solution of the iron much tarry matter separates, which is skimmed off, and the solution frequently agitated, to free it, as much as possible, from the tar. As soon as a strength is gained of a specific gravity of 1.09, at 60° Fahrenheit, the solution is allowed to cool, for a further quantity of impurities to separate. When clean turnings are operated on, the process of solution is completed in 5 to 7 days.

119. To make up a Blue Vat. Take 1 pound indigo, and grind in water until no grittiness can be felt between the fingers; put this into a deep vessel—casks are generally used—with about 12 gallons water; then add 2 pounds copperas, and 3 pounds newly-slaked lime, and stir for 15 minutes; stir again after 2 hours, and repeat every 2 hours for 5 or 6 times; towards the end, the liquor should be of a greenish yellow color, with blackish veins through it, and a rich froth of indigo on the surface. After standing 8 hours to settle, the vat is fit to use.

120. To make Blue Stone. Sulphate of copper is known in commerce as *Blue stone, Roman vitriol,* and *Blue vitriol,* and may be prepared by exposing pure copper in thin sheets to the joint action of dilute sulphuric acid and air; or by treating freshly precipitated oxide of copper with diluted pure oil of vitriol; or by boiling the metal with oil of vitriol, either in the concentrated state or diluted with an equal bulk of water. These are the simplest ways of obtaining this salt, which may be reduced to a crystalline form by evaporation. The crystals assume a well-defined rhomboidal form of a fine sapphire-blue color.

121. To make Solutions for Dyeing. In making solutions of copperas, blue stone, chrome, &c., there is no fixed rule to be followed. A quantity of the crystals are put into a vessel, and boiling water poured upon them and stirred until dissolved. Some salts require less water than others when saturated solutions are wanted; but in the dye-house saturation is not essential, and therefore there is always used ample water to dissolve the salt. In all cases, however, the proportions are known, so that the operator, when adding a gallon, or any other quantity of liquor to the dye-bath, knows how much salt that portion contains. From ½ to 1 pound per gallon is a common quantity.

122. To Prepare Cotton Yarn for Dyeing. Cotton yarn, when spun, is put up in *hanks,* a certain number of which combined constitute a *head;* the number of hanks ranging from 6 to 20, according as the fineness of the yarn varies from very coarse to very fine. Sufficient of these *heads* are tied together, or *banded* with stout twine into a bundle, to make 10 pounds.

After banding, the cotton is boiled in water for 2 or 3 hours until thoroughly wet. The bundles are then loosed, and each roll of yarn is put on a wooden pin, about 3 feet long and 1½ inches thick, 4 or 6 pins making a bundle. The yarn is now ready for dyeing dark colors; but for light shades, it must be bleached previous to dyeing. The bleaching is performed thus:

123. To Bleach Cotton Yarn. A vessel sufficiently large to allow of the yarn being worked in it freely without pressing, is to be two-thirds filled with boiling water; add 1 pint bleaching liquor (*see No.* 104) to every gallon of water in the vessel, and work the yarn in this for half an hour. Into another vessel of similar size, two-thirds filled with cold water, add one wine-glassful sulphuric acid for every 2 gallons water; stir well, and then put the yarn from the bleaching solution into this, and work for 10 minutes; then wash out until all the acid is removed. This will bleach the yarn for dyeing any light shade.

124. To Prepare Cotton Cloth for Dyeing. The cloth is taken out of the fold, and hanked up by the hand, taking the end through the hank and tying it loosely, technically termed *kinching;* it is then steeped over night in old alkaline lye, which loosens and removes the oil, grease and dressing which it has obtained in weaving; it is then thoroughly rinsed in clean water. Where there is a dash-wheel, it should be used for this washing. In consequence of the liquor often fermenting with the paste in the cloth, this process has been technically termed the *rot steep.*

If the cloth is to be dyed a dark color, no further preparation is needed; but if light, the cloth has to be bleached as follows:

125. To Bleach Cotton Cloth. After undergoing the *rot steep,* boil for 3 hours in caustic lye, of the strength of 1 gill of stock lye (*see No.* 101) to the gallon of water; wash out, and steep for 6 hours in a solution of 1 pint of bleaching liquor (*see No.* 104) to the gallon of water; wash, and steep 1 hour in a strong sour of 1 wine-glassful sulphuric acid to 1 gallon water; wash well from this before drying or dyeing.

If the cloth be very heavy, it may be necessary to repeat in their proper order the boiling in lye, the steeping in bleaching liquor, and in the sour, finishing, as before, with thorough washing or drying.

In bleaching cloth for dyeing, care has to be taken that it is all equally white, otherwise it will show in the color.

The quantity of water used should be sufficient to cover the cloth easily without pressure.

If the goods be old, and have previously been dyed, and if the shade required be a deep shade, and the color of the goods light, in that case nothing is generally required but steeping in alkaline lye to remove any grease or starch; but if the color of the cloth is dark, the best method is to bleach as if they were gray goods.

126. To Remove Oil Stains. When there are oil spots upon goods, and so fixed or dried in, that steeping in an alkaline lye will not remove them, rub a little soft soap upon the stain, and let it remain for an hour, then rub gently with the hand in a lather of soap, slightly warmed, and wash in water; for cotton, a little caustic lye will do equally well, but the soap is preferable, and seldom fails. It is essential that all oil or grease be removed before dyeing.

127. To Remove Iron Stains. Take a little hydrochloric acid in a basin or saucer, and make it slightly warm, then dip the iron stain into the acid for about 1 minute, which will dissolve the oxide of iron; the cloth must be well washed from this, first in water, then in a little soda and water, so as to remove all trace of acid. A little oxalic acid may be used instead of hydrochloric, but more time is required, and with old fixed spots is not so effective. The same precautions are necessary in washing out the acid, as oxalic acid dried in the cloth injures it.

128. To Remove Mildew from Cotton. Proceed with the stains by rubbing in soap or steeping in a little soda, washing, and then steeping in bleaching liquor (*see No.* 104), or by putting a wine-glassful of the stock liquor (*see No.* 101) in 1 pint of water; afterwards wash, pass through a sour (*see No.* 105), and wash again.

129. To Remove Indelible-Ink Marks. Steep in a little chlorine water or a weak solution of bleaching liquor (*see No.* 104), for about half an hour, then wash in ammonia water, which will obliterate the stain; then wash in clear water. They may also be removed by spreading the cloth with the ink marks over a basin filled with hot water; then moisten the ink marks with tincture of iodine, and immediately after take a feather and moisten the parts stained by the iodine with a solution of hyposulphate of soda, or caustic potassa or soda, until the color is removed; then let the cloth dip in the hot water; after a while wash well and dry.

130. Indigo Blue Dye for Yarn. The vats used for dyeing indigo blue are usually wine pipes or other large casks, sunk in the ground to a depth convenient for the operators to work at. Five of these constitute a set, and are worked together and kept of the same strength. The yarn being worked in quantities of 100 pounds, 20 pounds are passed through each vat.

Each vat is filled about three-fourths with cold water; there are then added 8 pounds of indigo, 16 pounds of sulphate of iron (copperas), and 24 pounds newly-slaked lime. The whole is well stirred with a rake for half an hour, and this stirring is repeated every 1½ hours for the first day.

The time to stop the stirring is known by the solution becoming a rich oak yellow, having large blue veins running through it and a fine indigo froth on the surface. When these signs are all favorable, the solution is allowed to stand for several hours till all the solid matter settles, when it is ready for use.

The mode of dyeing consists in simply immersing the goods, and working them in the solution for 15 minutes, taking out and wringing or pressing, and then exposing to the air; repeating this operation until the desired depth of color is obtained. The yarn is then washed in cold water and dried. When the shade required is very deep, the yarn may, previous to washing, be passed through a tub of water acidulated with vitriol till it tastes acid, and then washed; this adds brilliancy to the color.

131. Sky Blue Dye for Cotton Goods. To dye 10 pounds of cotton, first bleach the cotton (*see No.* 125); then, to a tub of cold water sufficient to work the goods easily, add ½ pint nitrate of iron, and work in this for 20 minutes; wring out, and pass through a tub of clean water. Into another tub of cold water add 4 ounces ferrocyanide of potassium in solution, and about a wine-glassful of sulphuric acid; work the goods in this for 15 minutes; wring out and wash through cold water, in which is dissolved 1 ounce of alum; wring out and dry. For lighter or darker shades of blue, use less or more of the iron and ferrocyanide; or, should the color be too light after passing through the process described, add 1 ounce more ferrocyanide, repeat the operation through the same tubs, and the shade will be deepened nearly double.

132. Napoleon Blue. For 10 pounds cotton goods, the cotton must be first bleached. Into a tub of cold water put 1 imperial pint of nitrate of iron and 2 gills hydrochloric acid, then add 3 ounces crystals of tin (or 1 pint chloride of tin); stir well and immediately work the goods in it for 30 minutes; wring out and put directly into the *prussiate tub*, made up with water into which is put a solution of 12 ounces ferrocyanide, and one wine-glassful of hydrochloric acid; work in this for 15 minutes, then wash out in clean water in which is dissolved 2 ounces of alum. If a deeper shade of blue is required, wash them in clean water without the alum, pass them again through the two tubs; and, lastly, wash them in water with the alum.

133. Royal Blue. This is dyed in the same manner as *Napoleon Blue*, but the liquors are stronger—using 2 pints iron solution, 2 gills hydrochloric acid, and 4 ounces tin crystals. The Prussiate tub is made up by dissolving in it 1 pound ferrocyanide of potassium, and adding 1 wine-glassful of sulphuric acid, and 1 of hydrochloric acid. If not dark enough with putting through once, repeat.

134. Blue. Copperas (sulphate of iron) is used as a mordant for dyeing blue by ferrocyanide of potassium (prussiate of potassium). The copperas best suited for the blue vat should be of a dark rusty green color, and free from copper, zinc, or alumina. Thus, 10 pounds cotton may be dyed a good rich blue by working it for 15 minutes in a solution of 4 pounds copperas; wring out; and then work through a solution of 4 ounces of the ferrocyanide; finally, wash in cold water containing 1 ounce alum in solution.

Copperas is also used as a dye by the oxidation of the iron within the fibre. Thus:

135. Iron Buff or Nankeen. Take 2 pounds copperas, and dissolve in warm water, then add the requisite quantity of water for working the goods; work in this for 20 minutes; wring out, and put immediately into another vessel filled with lime-water, and work in this for 15 minutes; wring out and expose to the air for half an hour, when the goods will assume a buff color. If the color is not sufficiently deep, the operation may be repeated, working through the same copperas solution, but using fresh lime-water each time. The goods should be finally washed through clean warm water and dried.

136. Nankeen or Buff Dye for Cotton Goods. To a tub of hot water add 1 pint nitrate of iron, and work in this for half an hour 10 pounds cotton previously bleached (*see No.* 125); wash out in water, and dry. This process is simple and easy, and produces a permanent dye.

137. General Receipts for Dyeing Cotton. In the following receipts, the quantities are given for 10 pounds cotton, whether yarn or cloth. For more or less cotton, the quantities can be increased or diminished in proportion; but when small articles are to be dyed—such as ribbons, gloves, &c.—a little more of the materials may be used in proportion to advantage. Where washing is referred to, it is always in cold water, unless otherwise specified.

138. Common Black. Steep the goods in a decoction of 3 pounds sumach while it is hot, and let them lie over night; wring out and work them for 10 minutes through lime-water, then work for half an hour in a solution of 2 pounds copperas. They may either be washed from this, or worked again through lime-water for 10 minutes; then work them for half an hour in a warm decoction of 3 pounds logwood, adding ½ pint chamber lye; before entering the goods, lift and raise with 2 ounces copperas in solution; work 10 minutes, then wash and dry.

139. Jet Black. The goods are dyed in the same manner as the last receipt; but along with the logwood is added 1 pound fustic.

In both the above receipts if 3 pints iron liquor (*see No.* 118) be used instead of the copperas, or in part mixed with the copperas, it makes a richer shade of black, but copperas is generally used; if mixed, use half the quantity of each.

140. Blue Black. Dye the goods first a good shade of blue by the vat (*see No.* 130), and then proceed as for common black. If the blue be very deep, then half the quantity of the materials for dyeing black will suffice.

141. Spirit Yellow. Work through a solution of protochloride of tin, of the specific gravity of 1° Baumé, for 30 minutes; wash out, and work for 15 minutes in a decoction of 3 pounds bark kept at a boiling heat; lift out the goods and add to the bark solution ½ pint single chloride of tin; work the goods for 20 minutes in this, and then wash well in cold water. This gives a rich yellow.

142. Spirit Brown. First dye the goods a spirit yellow, according to the last receipt; after washing, work for ½ hour in a decoction of 2 pounds lima or peachwood and 1 pound logwood; lift the goods out and add 3 ounces alum in solution, and work the goods in it 15 minutes; wash and dry. By varying the proportions of logwood and limawood, a variety of shades may be produced.

143. Mordant Brown. Steep the goods for six hours in a decoction of sumach, next dye a spirit yellow, according to the receipt given above. Then work for half an hour through a decoction of 2 pounds limawood and 8 ounces logwood; lift the goods, and add 2 ounces alum in solution; work for 15 minutes, wash and dry. This method is well adapted for cotton goods, is better than the spirits, and more easily performed by the non-practical man. The spirit brown is best for yarn.

144. Cinnamon Brown. Dye a dark spirit yellow (*see No.* 141), and work for 30 minutes in 3½ pounds limawood and ½ pound logwood; lift the goods and add 2 ounces alum in solution; wash and dry.

145. Uvanterin Brown. Dye a spirit yellow (*see No.* 141), then work for 20 minutes in a decoction of 1 pound limawood and 1 pound fustic; lift, and add ½ pint red liquor (*see No.* 100); work 10 minutes in this; wash and dry.

146. Fawn Brown. Take 1 part annotto liquor (*see No.* 95), and 1 part boiling water; stir well, and work the goods in it for 10 minutes; wring out and wash in two waters; then work for 20 minutes in a decoction of 2 pounds fustic and 1 pound sumach; lift, and add 3 ounces copperas in solution; stir well, and work for 20 minutes longer; then work for 20 minutes in a decoction of 8 ounces limawood, 8 ounces fustic, and 4 ounces logwood; lift, and add 1 ounce alum; work in this for 10 minutes; wring out and dry.

147. Catechu Brown. Work the goods at a boiling heat for 2 hours in 2 pounds of catechu prepared according to No. 96; wring out, and then work for half an hour in a hot solution of 6 ounces bichromate of potassa; wash from this in hot water. If a little soap be added to the wash water, the color is improved. Deeper shades of brown may be dyed by repeating the operation.

148. Catechu Chocolates. Dye brown according to the last receipt, then work for 15 minutes in a decoction of 1½ pounds logwood; lift, and add 3 ounces alum in solution; work 10 minutes longer; wash out and dry. Different shades of brown and chocolate can be produced, by varying the proportion of logwood, and the strength of the brown dye.

149. Chocolate, or French Brown. Dye a spirit yellow according to receipt No. 141; then work for half an hour in a decoction of 3 pounds logwood; lift, and add ½ pint of red liquor (*see No.* 100), and work 10 minutes longer; wash and dry. A deeper shade may be obtained by adding 1 pound fustic to the logwood.

150. Catechu Fawns. Work the goods 15 minutes in hot water containing 2 pints catechu, prepared as in receipt No. 96; wring out, and work 15 minutes in hot water containing 1 ounce bichromate of potassa in solution; wash and dry.

151. Catechu Fawns—Another Method. Work in the catechu the same as in the last receipt; wring out, and work for 15 minutes in warm water containing 2 ounces acetate of lead in solution; wash in cold water and dry.

152. Catechu Fawns—Another Method. Work in warm water containing 4 pints catechu (*see No.* 96), lift, and add 2 ounces copperas in solution, and work for 15 minutes; wash in water, and then in another tub of warm water in which sufficient soap has been dissolved to raise a lather, and then dry.

153. Common Red. Make a decoction of 3 pounds sumach, and put the goods in at once; let them steep over night; wring out and work for an hour in a mixture of 1 gill red spirits (*see No.* 108), to every gallon water; wring out and wash well; then work for half an hour in a decoction of 3 pounds limawood and 1 pound fustic, using this decoction as hot as the hand can bear it; lift, and add 1 gill red spirits, then work for 15 minutes more; wash out and dry.

154. Barwood Red. To a decoction of 2 pounds sumach, add a wine-glassful of vitriol, and steep the goods in it for 6 hours; wring out and work for an hour in red spirit (*see No.* 108), diluted to 2° Baumé; wring out and wash, then pass through a tub of warm water; put 10 pounds barwood into a boiler with water and bring it near to the boil, then put in the goods and work among the wood grains for ¾ hour; lift out, wash, wring and dry. Deeper shades may be dyed by using larger quantities of the materials in each operation.

155. Scarlet. For 1 pound of goods, boil 1¾ ounces cream of tartar in water in a block-tin vessel; add 1¾ ounces tin spirits, made according to the first receipt in No. 113; boil for 3 minutes, then boil the goods in it for 2 hours; drain and let the goods cool. Next boil ½ ounce cream of tartar for a few minutes in some water; add to it 1 ounce powdered cochineal, boil for 5 minutes, adding gradually 1 ounce tin spirits, stirring well all the time; then put in the goods and dye immediately.

156. Common Crimson. Steep over night in a decoction of 3 pounds sumach; work in spirits diluted 2° Baumé, wash and then work for 30 minutes in a decoction of 3 pounds limawood and 1 pound logwood; lift, and add a gill of red spirits (*see No.* 108); work for 15 minutes; wash and dry. A beautiful red crimson is obtained by omitting the logwood; and a diversity of tints dyed by varying the proportions of the limawood and logwood.

157. Light Straw. To a tub of cold water add 4 ounces acetate of lead in solution, work the goods in this for 15 minutes, and wring out; then work for 10 minutes in another tub of water containing 2 ounces bichromate of potassa; wring out, and work again in the lead solution for 10 minutes; wash and dry.

158. Leghorn. This tint is dyed in the same manner as the last, but adding ½ pint of annotto liquor (*see No.* 95) to the chrome solution. Different shades may be obtained by using more or less of these stuffs, without varying the mode of working.

159. Annotto Orange. Heat the annotto solution (*see No.* 95) to about 140° Fahr.; work the goods in it for 20 minutes; wring out thoroughly in order to economize the liquor, wash in a couple of waters and dry. If the goods are then passed through water with sufficient acid to taste sour, a very red orange, almost scarlet, is obtained, but the tint fades quickly.

160. Logwood Blue. Dye first a light blue with the vat (*see No.* 130), then soak the goods for several hours in a hot decoction of 2 pounds sumach; then work for 15 minutes in water containing 1 pint red liquor (*see No.* 100) and 1 pint iron liquor (*see No.* 118); wash in two waters, hot; then work for 20 minutes in a decoction of 2 pounds logwood; lift, and add ½ pint red liquor, and work again for 10 minutes; wash and dry.

161. Fustic Green on Yarn. Dye a blue with the vat (*see No.* 130), wash and wring, and then pass through red liquor (*see No.* 100) diluted to 4° Baumé; wash through a tub of hot water, and then work for 20 minutes in a decoction of 4 pounds fustic; lift, and add 2 ounces alum in solution; work for 15 minutes, wash and dry.

162. Fustic Green on Cloth. Work the goods in red liquor (*see No.* 100) diluted to 4° Baumé, and dry in a hot chamber; then wet in hot water and work for 20 minutes in a decoction of 3 pounds fustic; lift, and add 2 ounces alum in solution; work again for 15 minutes; wring out and work in *chemic* (a solution of sulphate of indigo whose acid has been neutralized with carbonate of soda); wring out and dry.

163. Dark Green on Cloth. After the goods have been cleaned, work them for 10 minutes in red liquor (*see No.* 100) at 5° Baumé; wring out, and pass through a tub of hot water; then work for half an hour in a decoction of 3 pounds bark; lift, and add ½ pint red liquor (*see No.* 100); work 10 minutes longer, then lift and drain; work next for 20 minutes in a tub of cold water containing 5 gallons chemic (*see last receipt*); wring out and dry. The depth of shade can be varied by increasing or diminishing the quantities of material in proportion.

164. Green with Prussian Blue. Dye a good Prussian blue (*see No.* 131) according to the depth of green required; then work 10 minutes in red liquor (*see No.* 100) at 4° Baumé; wash in warm water, and work for half an hour in a decoction of 3 pounds fustic; lift, and add 2 ounces alum in solution; work again for 10 minutes, wash and dry. A finer tint can be obtained by using bark instead of fustic, but it must not be worked too warm.

165. Sage Green. Dye a Prussian blue (*see No.* 131), and work 10 minutes in a solution of 2 pounds of alum; wring out, and work 15 minutes in a decoction of 1 pound fustic; lift, and add a pint of the alum solution already used; work 10 minutes; wash and dry.

166. Olive or Bottle Green. Dye a good shade of Prussian blue (*see No.* 131); then mordant 10 minutes in red liquor (*see No.* 100) at 5° Baumé; wring out and wash in hot water; then work half an hour in a decoction of 3 pounds fustic and 1 pound sumach, then add ½ pint of iron liquor (*see No.* 118), and work 15 minutes; wash in a tub containing 2 ounces alum, and dry.

167. Olive or Bottle Green—Another Method. Work the goods in red liquor (*see No.* 100) at 5° Baumé, wash out in warm water; then work for half an hour in a decoction of 3 pounds bark and 1 pound sumach; lift, and add ½ pint iron liquor (*see No.* 118), and work 15 minutes; wring out and work 15 minutes in the chemic (*see No.* 162); wring out and dry.

168. Olive Green. Dye a Prussian blue (*see No.* 131); then work for 10 minutes in red liquor (*see No.* 100) at 4° Baumé; wash in hot water, and work in a decoction of 3 pounds bark and 1 pound logwood; lift, and add ½ pint red liquor, and work 10 minutes; wash and dry. By varying the proportions of bark and logwood, different shades of green may be obtained.

If the goods be yarn, a light blue may be dyed by the vat (*see No.* 130) instead of the Prussian blue, and proceeded with as above.

169. Lilac or Puce. Work for an hour in red spirits (*see No.* 108) at 1½° Baumé; wring out and wash; then work half an hour in a decoction of 3 pounds logwood at about 140° Fahr.; lift, and add 1 gill red spirits, and work 20 minutes; wash and dry. Half a pint red liquor (*see No.* 100) or 2 ounces alum, may be added to the logwood after lifting, instead of the red spirit.

170. Lilac or Puce. Work for 15 minutes in red liquor (*see No.* 100) at 5° Baumé; wring out and wash in a tub of warm water; then work half an hour in a decoction of 2 pounds logwood at 140° Fahr.; lift, and add ½ pint red liquor, or 2 ounces alum; work 10 minutes, and wash in clean warm water; wring out and dry.

171. Light Purple or Adelaide. Steep the goods in a decoction of 2 pounds sumach; wring out, and work half an hour in plumb spirit (*see No.* 111); wring out, and wash in clean cold water until no taste of acid is left on the goods, and dry.

When working with the plumb spirit, it is advisable to put a sufficiency of it into a separate vessel for working the goods, returning the liquor afterwards to the plumb tub.

172. Light Purple. Steep in a decoction of 2 pounds sumach; wring out and work for 20 minutes in red spirits (*see No.* 108) at 1½° Baumé; wash well and then work in plumb spirit, and finish the same as the last receipt.

173. Purple. Steep in a decoction of 2 pounds sumach until cool; work in red spirits (*see No.* 108) at 1½° Baumé for an hour, and wash in cold water; then work for half an hour in a decoction of 3 pounds logwood at 140° Fahr.; lift, and add 1 gill red spirits, and work 10 minutes more; wash in cold water and dry.

If a browner tint is required, use a little more sumach; for a bluer tint, use less sumach and more logwood; and add, after lifting, ½ pint red liquor (*see No.* 100), or 2 ounces alum, instead of red spirits.

174. Lavender or Peach. Work for 20 minutes in plumb spirit (*see No.* 111); wring out, and wash in clean cold water till free from acid taste, and dry.

175. Logwood, Lilac or Puce. Dye a good shade of Prussian blue (*see No.* 131); then work 15 minutes in a decoction of 1 pound logwood at 140° Fahr.; lift, and add 4 ounces alum; work 10 minutes, then wash in cold water and dry.

176. Logwood Lilac. Dye a sky blue (*see No.* 131); then work for 15 minutes in a tub of warm water containing 1 gallon alum plumb (*see No.* 114); wring out and dry.

177. Common Drab. Work for 15 minutes in a decoction of ½ a pound sumach; lift, and add 1 ounce copperas in solution, and work 15 minutes more; wash out in a tub of cold water, then work 15 minutes in a decoction of 4 ounces fustic, 2 ounces limawood, and 1 ounce logwood; lift, and add 1 ounce alum in solution; work 10 minutes, then wring out and dry.

A great variety of different tints can be produced by varying the proportion of the limawood, fustic, and logwood; and lighter or darker shades by diminishing or increasing the quantities of sumach and copperas.

178. Olive Drab. Work for 15 minutes in ½ pound sumach; lift, and add 1 ounce copperas, and work 15 minutes more; wash in water, then work for 20 minutes in water with ½ pound fustic; lift, and add 1 ounce alum, and work for 10 minutes and dry.

179. Drab. To a tub of hot water add 1 pint annotto preparation (*see No.* 95), which gives a light salmon color; then proceed as for *olive drab* in last receipt. By varying the quantities a great variety of tints may be obtained.

180. Stone Color. Work the goods 20 minutes in a decoction of 1 pound sumach; lift, and add 1 ounce copperas in solution; work for 15 minutes, and wash in cold water; then work 10 minutes in warm water containing ½ pint alum plumb (*see No.* 114); wring out and dry. This gives a reddish tint, which may be avoided by using a solution of ½ ounce of alum instead of the alum plumb.

181. Catechu Stone Drab. Work the goods 15 minutes in hot water containing 2 pints prepared catechu (*see No.* 96); lift, and add 2 ounces copperas in solution; work for 15 minutes, and wash in water, then work for 10 minutes in a tub of warm water containing a decoction of 2 ounces logwood; lift, and add ½ ounce alum; work 10 minutes more, wring out and dry.

182. Catechu Drab. Work for 15 minutes in hot water containing 1 pint prepared catechu (*see No.* 96); lift, and add 1 ounce copperas; work 10 minutes; wash out and dry. A variety of tints may be obtained by finishing in a weak decoction of one or other of the different dye-woods.

183. Chrome Dyes for Cotton Goods. The following recipes will serve to illustrate the use and value of chrome (bichromate of potassa) as a dyeing agent. The quantities given are for dyeing 10 pounds weight of cotton, and may be increased or diminished in proportion, according to the quantity of goods to be dyed.

184. Light Straw. To a tub of cold water add 4 ounces acetate of lead, previously dissolved; work the goods through this for 15 minutes, and wring out; into another tub of water add 2 ounces bichromate of potassa; work the goods through this 10 minutes, wring out and pass again through the lead solution for 10 minutes; wash and dry.

185. Lemon Color. Into a tub of cold water put 1 pound acetate of lead, previously dissolved; work the goods in this for 15 minutes, and wring out; into another tub of cold water put 6 ounces bichromate of potassa in solution; work the goods for 15 minutes through this, and wring out; then work it 10 minutes in the lead solution; wring out, wash, and dry.

186. Deep Yellow. To a tub of cold water add 1 pound acetate of lead, and 1 pound nitrate of lead in solution; work the goods in this for 30 minutes, and wring out; then to a tub of warm water add 12 ounces bichromate of potassa, and work the goods in it for 15 minutes; expose to the air for half an hour, then pass again through both solutions, working them the same time in each as before, and expose to the air for one hour; then pass them through the lead solution; wring out, wash and dry. If the color is not deep enough they may be passed through the solutions again, observing the same rules.

187. Deep Amber Yellow. Put into a tub of water 1 pound acetate of lead, and to this add gradually caustic potassa or soda, until the precipitate formed be re-dissolved, taking care not to add more alkali than is required for this solution; work the goods in this for 30 minutes; wring out, and work for 15 minutes in another tub of water to which 8 ounces bichromate of potassa has been added in solution; wring out, wash and dry. 2 or 3 ounces sulphate of zinc may be added to the chrome solution with good effect. If a deep red amber be required, add to the chrome solution ½ pint muriatic acid.

188. Chrome Green. Dye a blue by

the process described in No. 131; then dye a yellow according to the last receipt. The depth of the blue and yellow will regulate the tint of green.

The principal difficulty is when a particular depth or shade of green is wanted, to ascertain the exact shade of blue to be given, as blue cannot be added upon the yellow. This is a matter which can only be learned by practice.

189. French Process for Dyeing Turkey-Red. The following process for dyeing turkey-red, is the one in general use in France at present.

The quantities of materials, &c., given, are for dyeing 2200 pounds of cotton, which has already, it is assumed, been subjected to thorough washing and scouring in soap.

Dissolve 20 to 22 pounds carbonate of potassa in about 330 gallons of water, and provide for future use 1300 to 1400 pounds of fat oil; next divide the goods to be dyed into three equal portions.

The first step in the process is *oiling* the goods; mix together one-third part of the fat oil and of the solution of potassa, stirring by degrees into the oil sufficient solution to produce an emulsion; this makes the *white liquor.*

One-third of the goods are padded, that is, drawn through evenly backwards and forwards, in this white liquor; then take them out and lay together in a heap in a fresh cool place for 10 or 12 hours, and dry in an atmosphere heated to 140° Fahr.

While the first portion of the goods is drying, prepare a second portion of white liquor, and subject a second portion of the goods to the same operation as the first; the remaining portion of the goods is in turn subjected to the same treatment, using the remainder of the fat oil for a third tub of white liquor; by this means the process proceeds without intermission, each portion being under different stages of treatment simultaneously.

This routine is repeated several times (generally seven or eight) on each portion, each always in its own tub, according to the quantity of oil which it is desired to fix on the goods. If the bath begins to fail, either a little tepid water is added, or a certain quantity of *old white liquor* proceeding from the washings.

The next stage is to remove superfluous oil; this is done by macerating the goods twice, successively, for 24 hours each time, in a solution of carbonate of potassa at 1° Baumé. The liquid which is wrung or pressed out of them constitutes the *old white liquor,* which may be employed again for filling up in the oiling operation. The goods are then carefully rinsed.

The third process is *galling* or *mordanting.* Bruise 22 pounds gall-nuts, and boil repeatedly until thoroughly drawn; add sufficient water to make up to 66 gallons; dissolve in this 35 pounds alum with the assistance of heat. This is sufficient for working one-half, that is, 1100 pounds of the cotton, which must be padded in the liquid at a temperature of about 160° Fahr.; it is next suspended for 2 days in a drying-room heated to 112° Fahr., and then passed into a hot concentrated bath of chalk. Care must be taken to work the goods very equally in this bath, in order to avoid streaking. The goods are then washed, and present a fawn-colored appearance.

The fourth step is *the first dyeing.* This is performed on 10 pieces at a time, the proportions of madder varying according to the breadth and length of the pieces, from 13, 15, 17 to 20 pounds madder for each piece. As in the preceding process, the madder is divided into two equal portions, one portion being used for the first dyeing, and the other portion reserved for the second dyeing. The one portion is mixed with the requisite quantity of water, from 300 to 400 gallons; the 10 pieces are introduced into this bath at a tepid heat, and kept in it 3 hours, the temperature being gradually increased, until, at the end of 2¾ hours, boiling point is reached; and this heat is sustained for the remaining ¼ hour. The goods must then be washed, thoroughly cleansed, rinsed and dried.

The fifth stage is the *second galling;* which is prepared in the same gall liquid, and in the same manner as the *first galling,* finishing with the chalk bath, washing and drying.

The sixth operation is the *second dyeing,* an exact repetition of the *first dyeing,* using the remaining half of the madder reserved for this purpose.

The seventh step, *first clearing,* is performed in a close boiler, two-thirds filled with water containing in solution 13 pounds soap, and 3½ pounds carbonate of potassa; the goods are boiled in this for 8 hours.

The eighth process is a *second clearing,* conducted in the same manner as the *first clearing,* but dissolving in the water 14½ pounds soap, and 14 ounces chloride of tin instead of the potassa solution.

For only very lively reds a *third clearing,* similar to the second, is required. The goods, after clearing, are exposed for some time in the air; then worked through a bran bath, which adds to the brightness of the color.

The process here described is slightly modified by some French dyers; thus, experience proves that the oil is better fixed in the stuff when the drying is not performed too rapidly; and there are some who, when the season does not admit of exposure to the air, heap the pieces together, after oiling, in a drying-room heated to 95° Fahr., turning them over from time to time to prevent injury from overheating. Some use ox-blood in the proportion of 40 pounds blood to 100 pounds madder.

190. Violet. Dye a turkey red (*see No.* 189), and then pass through the blue vat. (*See No.* 130.)

191. Preparation and Dyeing of Woolens. To prepare new woolen goods for dyeing, the cloth or yarn (if the latter, it is first banded with twine into spindles, *see No.* 122,) is steeped over night in soap lye, and then scoured through clean soap to remove all oil or grease that may be upon the wool. Instead of soap, a scouring mixture may be prepared with 1 pound soft soap and 1 pound common soda (or ½ pound soda-ash), in 10 gallons water.

Goods to be re-dyed must first be steeped and scoured in soap and soda. If the remaining color be unequal or dark, the goods must be worked for a short time in a sour, made by dissolving 2 ounces bisulphate of potassa in each gallon of water used. Woolen goods are always dyed hot, as near boiling point as possible; this necessitates the use of boilers, which should be of copper, or copper and tin, as iron will not answer the purpose. The dye-stuffs are generally put in the boiler, and the goods worked with it, but it is cleaner to make decoctions (*see No.* 94), and use the clear liquor. All washings are to be in cold water unless otherwise specified. The quantities given in the following receipts are for dyeing 10 pounds of woolen goods, either cloth or yarn, unless otherwise specified.

192. Black. Work for 20 minutes in a bath with 8 ounces camwood; lift, and add 8 ounces copperas; work 20 minutes more, then withdraw the fire from the boiler, and submerge the goods in the liquor over night, then wash out. Work for an hour in another bath containing a decoction of 5 pounds logwood and 1 pint chamber lye; lift, and add 4 ounces copperas; work for 30 minutes longer, wash and dry.

193. Brown. Work for an hour in a bath made up with 2 pounds fustic, 2 pounds madder, 1 pound peachwood, and 4 ounces of logwood; lift, and add 2 ounces copperas; work for 30 minutes, wash and dry.

194. Brown Dye. The different shades of this dye vary from pale yellow and reddish brown up to very dark brown, almost black, every shade of which, however, may be produced, as the taste of the workman may dictate, by mixtures of reds and yellows with blues and blacks, or by simple dyes, which at once impart a brown,—as catechu, walnut rinds, or oxide of manganese.

Boil the cloth in a mordant of alum and common salt dissolved in water, then dye it in a bath of logwood, to which a little green copperas has been added. The proportion of alum should be 2 ounces, and of salt 1 ounce, to every pound of cloth.

Or boil the goods in a mordant of alum and sulphate of iron, then rinse them through a bath of madder. The tint depends on the relative proportions of the alum and copperas; the more of the latter, the darker will be the dye. The joint weight of the two should not exceed ⅛ of the weight of the wool. The best proportions are 2 parts of alum and 3 of copperas.

For other receipts for dyeing black and brown see Index.

195. Crimson. Work in a bath for one hour with 1 pound cochineal paste, 6 ounces dry cochineal, 1 pound tartar, and 1 pint protochloride (single chloride) of tin; wash out and dry.

196. Scarlet. Work for an hour in a bath with 1 pound tartar, 2 ounces dry cochineal, 8 ounces sumach and 8 ounces fustic; wash out and dry.

197. Red. Work for 30 minutes in a bath made up with 1 ounce chrome and 1 ounce alum; wash in cold water; then work for 30 minutes in another bath with three pounds peachwood or limawood; lift, and add 1 ounce alum; work for 20 minutes; wash and dry.

198. Claret Red. Work for an hour in 5 ounces camwood; lift, and expose the goods until well drained and cold; meanwhile, add to the camwood bath 4 ounces copperas, 2 ounces alum, and 8 ounces logwood; work the goods for 30 minutes, wash and dry.

199. Scarlet. For every 100 pounds of fabric, boil, in a suitable kettle, 11 pounds ground Honduras cochineal, 5 pounds half-refined tartar or 3 pounds tartaric acid, 2 pounds oxalic acid, 1 pound tin crystals, 1½ pounds flavine, 10 pounds scarlet spirit (*see below*). After it has boiled for about fifteen minutes, cool the dye to 180° Fah., enter the goods, handle them quickly at first, and let them boil slowly for 1 hour, when they will be a good scarlet. Take them out, cool, and rinse in cold water. If it should happen that the wool or flannel shows some white hair, which is generally the case when new wool is used, then add 5 pounds of raw muriatic acid to the dye. This powerful agent will work wonders in scarlets, oranges, and pinks, as it tans the wool, which is perhaps a little greasy, and prevents the tin crystals from fastening too quickly to it, and thereby evener colors are obtained. This latter fact is very valuable, and not generally known.

Scarlet spirit is thus prepared: Take 16 pounds muriatic acid 22° Baumé, 1 pound feathered tin, 2 pounds water. The acid should be put in a stoneware pot, and the tin added, and allowed to dissolve; the mixture should be kept a few days before using.

200. Lac Scarlet. Work for 30 minutes in a bath with 1 pound tartar, 8 ounces sumach, and 2 pounds lac; lift, and add about a gill of bichloride of tin; work for 30 minutes, wash and dry.

201. Pink. Work for an hour in a bath made up with 1 pound tartar, 8 ounces alum, 1 pound cochineal paste, and 1 gill red spirits (*see No.* 108); wash in cold water and dry.

202. Yellow. Work for 20 minutes in a bath of water containing 8 ounces tartar and 8 ounces alum; lift, and add 2 pounds bark, 8 ounces sumach, 8 ounces fustic, and 1 pint red spirits (*see No.* 108); work in this for 40 minutes, wash out and dry.

203. Orange. Work for 40 minutes in 2 pounds sumach, 3 ounces dry cochineal, 1 pound fustic, 8 ounces tartar, and 1 pint red spirits (*see No.* 108); wash and dry.

204. Sky Blue. Work for 30 minutes in a bath containing 8 ounces argol, 1 pound alum, and 1 gill indigo extract (*see No.* 99); wash out and dry. The shade of blue will depend on the quantity of indigo extract used.

For other shades of blue see Index.

205. Pigeon Blue. Work for 40 minutes in 2 ounces chrome (bichromate of potash), 4 ounces alum, and 1 ounce tartar; wash out in cold water, and then work for 30 minutes in another bath made up with 3 pounds logwood; lift, and add 1 ounce verdigris; work for 15 minutes, wash and dry.

206. Apple Green. Work for 30 minutes in a bath with one ounce chrome and 1 ounce alum; wash through cold water, then work for 30 minutes in another bath with 2 pounds fustic and 8 ounces logwood; wash and dry. Different proportions of the materials used will produce different shades.

207. Green. Work for 15 minutes in 5 pounds fustic, 2 ounces argol, and 5 ounces alum; lift, and add ½ gill of indigo extract (*see No.* 99); work for 30 minutes and dry.

More or less indigo extract will make the green bluer or yellower, as required.

208. Fast Green. First dye a blue in the indigo vat (*see No.* 130) according to the depth of the green required; then work for an hour in a bath with 4 pounds fustic and 2 pounds alum; dry out.

209. Olive. Work for an hour in a bath made up with 10 ounces fustic, 8 ounces logwood, 4 ounces madder, and 2 ounces peachwood; lift, and add 4 ounces copperas in solution; work for 30 minutes and dry.

210. Wine Color. Work for an hour in a bath with 4 pounds cudbear, and dry. For a darker shade use more cudbear. If the tint be desired bluer, add, after 30 minutes working, 1 gill ammonia; if a redder tint is wanted, add a wine-glassful of hydrochloric acid; but if this last be used, the goods must be washed out before drying.

211. Light Violet. Work for an hour in a bath with 4 ounces cudbear, 4 ounces logwood, 2 ounces barwood or camwood, and 2 ounces peachwood; lift, and add 2 ounces alum in solution, work for 30 minutes and dry.

212. Lilac or Puce. Work in a bath for one hour with 10 ounces logwood, 1 ounce camwood and 8 pounds cudbear; lift, and add 2 ounces copperas in solution; work for half an hour and dry.

213. Brown Drab. Work for 30 minutes in a bath with 2 ounces ground madder, 1 ounce peachwood, 2 ounces logwood, and 6 ounces fustic; lift, and add 3 ounces copperas in solution; mix well and work the goods for 30 minutes more; then wash and dry. The shade can be adjusted to suit, varying the quantities and proportions of the dye-woods.

214. Properties of Dye-woods. Peachwood reddens, madder gives the drab tint, fustic supplies yellowness, and logwood induces a slate hue.

215. Stone Drab. Work the goods for 20 minutes in a bath containing 1 ounce peachwood or limawood, 2 ounces logwood and ½ ounce fustic; lift, and add 1 ounce copperas in solution; stir well and work in this for 30 minutes; lift out and expose to the air for a short time; wash and dry. Different shades are made by varying the quantities of the dye-woods. (*See last receipt.*)

216. Slate. Work for half an hour in a bath with 8 ounces logwood and 1 ounce fustic; lift, and add 1 ounce alum and ½ ounce copperas in solution; work for half an hour; wash and dry. For a bluer tint, use less alum and more copperas; for more purple, use less fustic and more alum, &c.

217. Blue. Dyeing woolens blue is performed by dipping in the blue vat (*see No.* 130), and then exposing to the air, repeating the operation till the desired depth of color is obtained.

218. Blue Purple. 100 pounds wool are first dipped a light blue in the vat, and well rinsed. Then take a stone pot, put in 3 pounds tartar, 3 pounds feathered tin, 5 pounds blue vitriol, and 20 pounds muriatic acid; heat all in a sand bath until dissolved.

From this mordant take 10 pounds in a suitable kettle; add 5 pounds tartar to it, stir it well, and enter the wool at 170° Fahr.; let it boil for 1 hour; take it out, cool, and let it lay for 24 hours. Then boil out 20 pounds good logwood for ¾ hour in fresh water; cool off the kettle to 150° Fahr., enter the wool, and handle it well for an hour, then heat it up to 185° Fahr., but do not let it boil; let it go for 1 hour more, when it will be a dark purple. This color stands the sun remarkably well, perhaps owing to the fact that there is not any alum or sulphuric acid used, except that contained in the blue vitriol.

219. Blue Purple, Fast Color. 100 pounds of wool are first dipped in the blue vat to a light shade, then boiled in a solution of 15 pounds alum, and 3 pounds half-refined tartar, for 1½ hours; the wool taken out, cooled, and let stand 24 hours. Then boil in fresh water 8 pounds powdered cochineal for a few minutes; cool the kettle to 170° Fahr.; handle the prepared wool in this for 1 hour, in which time let it boil for ¾ hour, when it is ready to cool, rinse, and dry. By coloring first with cochineal, as above, and finishing in the blue vat, the fast purple, or dahlia, so much admired in German broadcloths, will be produced.

220. Royal Blue Dye for Woolen Goods. Woolens may be dyed different shades of blue with nitrate of iron, observing the general rule that woolens must be worked at a boiling heat.

To dye 5 pounds of woolen goods—work for 20 minutes in a bath with 1 pound ferrocyanide of potassium, and lift; then take ½ pint nitrate of iron and add to it 1 ounce crystals of tin (or 1 pint chloride of tin); stir well for a few minutes and then add this mixture to the bath, and work the goods in this for 30 minutes; wash out and dry. For various shades of color, increase or diminish the quantities in proportion.

221. Chrome Dyes for Woolen Goods. The quantities given in the following receipts are for dyeing 5 pounds of woolen goods, unless otherwise stated. It must be understood that the goods must be cleaned before dyeing, and the dyeing must always be performed at a boiling heat.

222. Black. Work for 1 hour in a bath with 8 ounces bichromate of potassa, 6 ounces alum, and 4 ounces fustic; lift, and expose to the air for a short time; wash well, and then work for 1 hour in another bath with 4 pounds logwood, 4 ounces barwood, and 4 ounces fustic; lift, and add 4 ounces copperas in solution; work half an hour in this, and then wash and dry. In order to dye a blue black, the goods must be first dyed blue by the vat (*see No.* 130) or otherwise, and then proceeded with as for black, only using less materials.

223. Brown. Work for half an hour in 8 ounces of bichromate of potassa; lift, and expose till cold; then work an hour in 2 pounds fustic, 4 ounces madder, 3 ounces cudbear, 4 ounces tartar, 2 ounces logwood; lift out and dry; or it may be washed before drying

224. Rich Yellow Brown. Work for an hour in the following bath: 2 ounces bichromate of potassa, 2 ounces argol, 2 ounces alum; wash from this bath; then work about 40 minutes in another bath made up with 2 pounds fustic, 1 pound madder, 8 ounces peachwood, and 4 ounces logwood; wash out and dry. This gives a very beautiful brown; and a great variety of tints and shades may be made by varying the quantities of the last bath, the first bath remaining the same.

225. Rich Yellow. Work for half an hour in a bath with 3 ounces bichromate of potassa and 2 ounces alum; lift, and expose till well cooled and drained; then work for ½ hour in another bath with 5 pounds fustic; wash out and dry.

226. Bottle Green. Work for an hour in a bath with 2 ounces bichromate of potassa and 4 ounces alum; lift out and expose to the air till cold; then work for an hour in a second bath with 3 pounds fustic, 1½ pounds logwood; wash out and dry.

227. Invisible Green. Work for an hour in a bath with 3 ounces bichromate of potassa, 4 ounces alum; lift, and expose to the air for some time; then work for an hour in a second bath with 2 pounds fustic, 3½ pounds logwood; wash out and dry. By comparing these last two receipts it will be seen that the different shades are produced by varying the proportions of the same dye-stuffs, and will serve as a guide for other shades of dark green.

228. Olive. Work for an hour in a bath with 4 ounces chrome, 2 ounces alum; lift and expose to the air; then work for an hour in a bath with 3 pounds fustic, 1½ pounds camwood, 1 pound logwood; lift out and dry.

229. Purple. Work the goods half an hour in a bath with 1 ounce bichromate of potassa, 1 ounce alum; lift out and wash in cold water; and then work half an hour in a bath with 2 pounds logwood, 1 pound peachwood; lift, and add 1 ounce alum in solution; work in this for 20 minutes; wash and dry. If a lighter and redder shade be required, use less logwood and more peachwood. For a darker shade use more of each.

230. Rich Green Drab. Work the goods 30 minutes in a bath with 1 ounce bichromate of potassa, ½ ounce alum, ½ ounce tartar; lift out and wash in cold water; then work for half an hour in another bath with 4 ounces logwood, 2 ounces fustic, 1 ounce barwood (or ½ ounce peachwood); wash and dry. The shades of this can be varied by using different proportions of the stuffs.

231. Rich Drab. Work for 30 minutes in ½ ounce bichromate of potassa; lift, and add 1 ounce of logwood; work in this for 30 minutes; lift out, wash and dry. Different proportions will produce different shades of color.

232. Chrome Blue. 100 pounds of wool are boiled for one hour in a solution of 3 pounds bichromate of potash, 6 pounds alum, 1 pound half-refined tartar; then it is taken out, cooled, and rinsed. Boil 6 pounds good logwood in a bag for half an hour in fresh water, add 3 pounds cudbear, well moistened and dissolved. Cool the dye to 180° Fahr. Enter the prepared wool, and handle it for ¾ of an hour; bring it to a boil in this time. This color ought to be always left a shade lighter when finished, as all chrome colors darken in drying.

In the foregoing receipts, the quantity of water to be used is not material, but will be regulated according to the size of the vessel and the amount of goods to be dyed, but there should always be enough water to cover the goods without the necessity of pressing them down.

Rules for making decoctions, &c., will be found in No. 94.

233. Preparing and Dyeing Silk. New silk is banded in the same manner as cotton (*see No.* 122), in quantities convenient for making up into skeins when finished. After banding, it is tied up carefully in fine canvas bags and boiled three or four hours in strong soap-water to remove all the gum. Yellow silk must be first worked on sticks for an hour in a solution of soft soap at a temperature of about 200° Fahr., and then boiled in bags. It is then washed from the soap and put on sticks for dyeing.

Silk goods to be re-dyed must be steeped in a strong soap solution at nearly boiling point for a few hours, to remove all stains and grease; they are then washed, and if the color on them is light and equal, and they are to be dyed dark, then no further preparation is required; but if the color is unequal, they must be soaked for 15 minutes in a *sour* (*see No.* 105), and then washed out.

The quantities given in the following receipts are for five pounds of silk. If the goods are tightly spun, such as ribbons, dress silk, &c., the quantities must be slightly increased.

There must be sufficient water used to cover the goods laying loosely. When goods are washed from the dye, it is always to be in cold water, unless otherwise stated.

234. Black. Work for an hour in a solution of 8 ounces copperas; wash well out in cold water; then work in a decoction of 4 pounds logwood, adding to it ½ pint chamber lye; lift, and add 2 ounces copperas in solution; work 15 minutes, wash and dry.

This gives a good black, but not very deep.

235. Deep Black. Work for an hour in a solution of 8 ounces copperas (sulphate of iron), and 2 fluid ounces nitrate of iron; and, after washing out, work in the decoction of logwood and chamber lye, as in the last receipt, finishing as there directed.

236. Blue Black. If a *blue black* is required, follow the same directions, but add a little white soap, instead of the chamber lye, to the logwood decoction, and add no copperas after lifting.

237. Full Deep Black. Work for 1 hour in a solution of 1 pound copperas and 2 ounces nitrate of iron; wash out, and work for an hour in a decoction of 5 pounds logwood and 1 pound fustic; lift, and add 2 ounces copperas, and work 10 minutes; wash and finish. If the color is not deep enough, add a little more logwood before lifting.

238. French Black. Work for an hour in a solution of 1 pound copperas and 4 ounces alum; wash out well, then work for an hour in a decoction of 4 pounds logwood, with a little white soap added; wash out and finish.

239. Blue Black by Prussiate. Dye a deep Prussian blue according to receipt No. 131, and work, from the prussiate, for half an hour, in 8 ounces copperas; wash well out in cold water, and then work for half an hour in a decoction of 2 pounds logwood;

lift, and add a little of the copperas solution first used, then work for 10 minutes more; wash and dry.

240. Deep Hat Black. Work for 15 minutes in a decoction of 2 pounds fustic and 1 pound bark; lift, and add 6 ounces acetate of copper and 6 ounces copperas in solution; work for 15 minutes more; then sink the silk below the surface and let it steep over night; lift out and wash; then, to a decoction of 5 pounds logwood, add white soap sufficient to make a lather, and work the silk in it for an hour; wash out and dry.

241. Brown. Dye an annotto orange (*see No.* 159); then work for 20 minutes in a decoction of 3 pounds fustic, 8 ounces sumach and 8 ounces peachwood; lift, and add 3 ounces copperas in solution, and work for 15 minutes; wash out in two waters, adding ½ pint alum solution in the last water. If the particular tint is not obtained, it may be given in the last alum-wash by adding as follows: for yellowness, a little fustic; for redness, a little peachwood; for depth or blueness, logwood. A number of different tints of brown may be obtained by varying the proportions of fustic, sumach and peachwood. A great many particular hues of brown may be dyed by this method; for instance, by using only fustic and sumach in the second operation, a California brown is obtained, &c. So that any intelligent person may regulate his colors and tints.

242. Red Brown. Dye a deep annotto orange (*see No.* 159); then work for 15 minutes in plumb liquor (*see No.* 111); wash well and dry. Particular tints can be made by adding fustic, peachwood or logwood to the last washing, as described in the last receipt.

243. Red Brown. Steep the silk for an hour in a solution of 8 ounces alum to each gallon water, then wash out in warm water; next, work half an hour in a decoction of 1½ pounds fustic, 1½ pounds peachwood, and 8 ounces logwood; lift, and add 1 pint of the alum solution; work 10 minutes, wash and dry.

244. Chocolate Brown. Steep the silk for an hour in a solution of 1 pound alum to each gallon of water; wash once in warm water, and then work for half an hour in a decoction of 3 pounds peachwood and 1 pound logwood; lift, and add 1 pint of the alum solution, work again for 15 minutes; wash out and dry.

For deeper shades use less peachwood and more logwood; for a still deeper tint, add about 4 ounces fustic.

245. Bronze Brown. Work for half an hour in a decoction of 8 ounces fustic, to which 4 fluid ounces of archil liquor has been added; lift, and add 2 ounces solution of copperas; work 15 minutes, wash and finish.

246. Cochineal Crimson. To every gallon of water used, add about 2 fluid ounces bichloride (oxychloride) of tin, allow any sediment to settle, and warm the clear solution; work the silk in this for an hour or more. Boil 2 pounds cochineal by suspending it in a bag on the surface of some water; add this to a quantity of water sufficient for working the goods, and bring it to a blood heat. Wring the silk from the tin solution and work it in the cochineal solution for ½ hour; then let it steep for several hours well under the liquor; wash out well in cold water. If the shade is not blue enough, add to the water a little cochineal dissolved in ammonia; work in it for 10 minutes, wring out and dry.

247. Common Red. Work the goods for 15 minutes in a decoction of 2 pounds peachwood and 1 pound fustic; lift, and add 4 fluid ounces red spirits (*see No.* 108); work for 15 minutes, wash in cold water and finish.

Different shades are made by varying the proportions, and claret tints are obtained by adding a little logwood. These common dyes are apt to fade.

248. Cochineal Pink. This is dyed in the same manner as cochineal crimson (*see No.* 246), using much less cochineal; about half a pound makes a good pink, and intermediate shades are produced by adjusting the proportion of cochineal.

249. Cochineal Scarlet. First dye a deep annotto orange (*see No.* 159); then dye a cochineal crimson according to No. 246.

250. Mixture for Dyeing Common Reds. Make a strong decoction by boiling 1 pound limawood or brazilwood to each gallon of water. Let the wood settle; decant the liquor, and let it stand to cool for 24 hours; decant the clear liquor and add ½ pint plumb spirits (*see No.* 111) to every gallon of liquor; after standing a few hours it is ready for use.

251. Common Crimson. Put some of the common red mixture (*see No.* 250) into a copper or stoneware vessel, and work the goods in it for ½ an hour; then wash out thoroughly, wring and dry.

252. Common Scarlet. Dye an annotto orange (*see No.* 159), then dye a common crimson according to the last receipt.

253. Ruby, Maroon, &c. Take 1 pound cudbear, and boil in a bag for 15 minutes; and work the silk in this for ½ an hour.

For a *bluish* tint, lift, and add 3 fluid ounces liquid ammonia; work 10 minutes, wring and dry.

For a *red* tint, lift, and instead of the ammonia, add 2 fluid ounces red spirits (*see No.* 108); work 10 minutes, wring and dry.

For a *brownish* hue, make a decoction of 1 pound cudbear and 4 ounces fustic; work for ½ an hour; lift, and add 2 ounces red spirits; work for 10 minutes and finish.

For a *deep violet* hue, proceed as in the last receipt, using 4 ounces logwood instead of the fustic.

254. Sky Blue. To 1 pint sulphate of indigo add 2 or 3 gallons boiling water; steep in this a piece of woolen cloth, such as an old blanket, for a day; take it out and wash in cold water.

If the *sky blue* is required to be light, warm some water in a vessel to about 98° Fahr., steep the woolen cloth in it for a few minutes, and wring out; this will leave sufficient blue in the water to dye the silk; add 1 ounce alum in solution, and work the silk in it for 20 minutes; wring out and dry.

255. Dark Blue. If a *deep blue* be required, blue the water as before with the woolen cloth, add 1 ounce pearlash; then add 1 ounce alum in solution, with a few drops of sulphuric acid; then work the silk in it as before.

Half an ounce of indigo extract (*see No.* 99) may be used for bluing the water, instead of using the woolen cloth for that purpose. The exact quantity of indigo extract depends on the shade of blue required.

256. Sky Blue Dye for Silks. For 5 pounds of silk goods, add to a sufficient quantity of water to work the goods ½ pint of nitrate of iron; work in this for 20 minutes, then wash out in cold water. Into another vessel of cold water add 3 ounces ferrocyanide of potassium in solution, and 1 fluid ounce of strong sulphuric acid; work through this for 10 minutes, then wash in cold water with 1 ounce of alum dissolved in it, and finish.

257. Royal Blue. Into a vessel of cold water add 2 pints nitrate of iron; then take 1 pint water and ½ pint of hydrochloric acid, and add to it 3 ounces crystals of tin; when dissolved, add this (or 1 pint chloride of tin) to the vessel containing the iron; stir well and work the goods in it immediately for half an hour. Into another tub dissolve 8 ounces of the ferrocyanide, and add to it 2 fluid ounces of sulphuric acid; the goods are wrung out of the iron solution, and put directly into this second vessel, and worked for 15 minutes; then wash out in cold water with 2 ounces of alum dissolved in it, and finish. If the shade is not sufficiently deep, before washing them in the alum water, they may be passed through the iron solution, and the ferrocyanide solution, working in each the same time as at first, only adding 2 ounces more ferrocyanide before passing the goods through the second time; then finish as before stated. Deeper shades are obtained by using more iron and tin, or by repeating the dips. Some wash out the iron solution in water before going into the ferrocyanide, and also wash it again in clean water before putting back into the iron; the shade will not be so deep, but there is less risk of an unequal color.

258. Rich Deep Blue Dye for Silk Goods. To dye 5 pounds of silk goods, add to the water required to work the silk, 2 pints chloride of iron and 1 pint *double muriate* or chloride of tin; work in this half an hour; lift, and work in a solution of 8 ounces ferrocyanide of potassium; if the color be not deep enough, repeat the operation through both solutions; then wash out in water in which 2 ounces of alum have been dissolved.

259. Deep Blue Dye for Woolen Goods. To dye 5 pounds woolen goods, add to the requisite quantity of water, 2 pints chloride of iron and 1 pint chloride of tin; work in this for half an hour; lift, and work half an hour in a bath with 4 ounces of the ferrocyanide. If the color is required to be deeper, repeat this through the same stuff, adding 2 ounces more ferrocyanide; then wash out in cold water, and dry.

260. Lavender. Add 1 pint plumb liquor (*see No.* 111) to sufficient water to work the goods easily; stir well and work in this for 20 minutes, then wash in cold water and dry. A darker or lighter tint is obtained by using more or less plumb liquor.

If a *blue* tint is required, add to the solution before putting in the goods, 2 or 3 drops either of sulphate, or of extract of indigo. (*See Nos.* 98 *and* 99).

261. Fine Lavender. Into a vessel of water as hot as the hand can bear, dissolve a little white soap—enough to raise a lather; then add 1 gill archil liquor, and work the goods for 15 minutes, wring out and dry. To obtain a *redder* tint, boil 1 ounce cudbear, and use instead of the archil liquor. A *still redder* tint is attainable by leaving out the soap altogether.

262. Violet, Lilac, Wine Color, &c. Work the goods for 20 minutes in plumb liquor (*see No.* 111) in a copper pan or stoneware vessel; wash out repeatedly until the goods cease to taste of the liquor, then dry. To obtain a rich blue shade, add to the plumb liquor 1 fluid ounce either sulphate or extract of indigo. For a *red* shade, first dye a lavender by cudbear without soap. (*See No.* 261.)

263. French and Pearl White. Dissolve in hot water sufficient white soap to make a lather; then add ½ fluid ounce archil liquor; work the goods for 10 minutes, and wash out. A little cudbear may be used instead of archil, less or more, according to the shade required.

264. French and Pearl White. Put 1 fluid ounce plumb liquor (*see No.* 111) into a vessel of cold water; work the goods in it for 10 minutes; wash out and dry. For these shades the goods must be perfectly white (*see No.* 233) previous to dyeing.

265. Weld Yellow. Work the silk for an hour in a solution of alum, about 1 pound to the gallon; wring out and wash in warm water. Boil 2 pounds weld, strain the liquor, and work the silk in it for 30 minutes; lift, and add 1 pint of the alum in solution, to the weld liquor; work the silk 10 minutes longer, wring out and dry.

This gives a rich lemon yellow; deeper shades are made by using more weld: straw and amber tints are obtained by the use of a little annotto.

266. Bark Yellow. The process is the same as for dyeing *weld yellow,* using 2 pounds bark instead of the weld. The bark should be boiled in a bag.

267. Deep Rich Yellow. Proceed as in the receipt for *bark yellow;* except that, after lifting, instead of a pint of the alum solution, 2 fluid ounces single chloride of tin are added to the bark liquor; work 10 minutes, wash in water, and finish in a solution of white soap.

268. Gold and Straw. To warm water containing white soap, add 2 pints annotto liquor (*see No.* 95), work in this 15 minutes; wash out, then work for 20 minutes in a decoction of 8 ounces bark; lift, and add 1 fluid ounce red spirits (*see No.* 108); work 10 minutes more, wash out and finish. Different quantities of annotto and bark produce different shades.

269. Nankeen, Buff, &c. Make a solution of soap in warm water, add to it 1 pint annotto liquor (*see No.* 95); work in this for 20 minutes, wring out and finish; a deeper shade is obtained by using more annotto.

270. Salmon, Flesh, &c. Dye a nankeen according to the previous receipt, and add 2 ounces alum in solution to the cold water used for finishing.

271. Orange. Work the silk for 15 minutes in a strong warm solution of annotto (*see No.* 95); wash out in warm water and dry.

272. Yellow Drab. Into a vessel of warm water put 1 pint annotto liquor (*see No.* 95); work for 15 minutes and wash; then work for 15 minutes in a decoction of ½ pound sumach and 1 pound fustic; lift, and add 4 ounces copperas and 1 ounce alum in solution; work 10 minutes, wash in cold water and dry. A variety of drabs may be dyed in this way by varying the proportions of the sumach and fustic, and by introducing a little logwood or peachwood.

273. Drab. Work for 15 minutes in a decoction of 8 ounces sumach and 8 ounces fustic; lift, and add 4 ounces copperas; work for 20 minutes, and wash out in cold water; then work 15 minutes in a vessel of warm water containing ½ pint archil liquor, and dry.

274. Greenish Drab. For a greenish drab, add to the archil liquor a decoction of 4 ounces fustic and ½ fluid ounce chemic. (*See No.* 162).

For a purple tint, use 1 ounce alum in solution, instead of the chemic.

275. Slate or Stone Color. Work the silk for 30 minutes in a decoction of 1 pound sumach, 4 ounces fustic, and 4 ounces logwood; lift, and add a solution of 4 ounces copperas; work 30 minutes more, wash in cold water, and finish.

For different tints, vary the proportion of sumach, &c.

276. Common Green. Steep for an hour in a solution of 1 pound alum to the gallon of water; wash in warm water, then work for 30 minutes in a decoction of 6 pounds fustic; lift, and add 2 fluid ounces indigo extract (*see No.* 99); work for 30 minutes more, wash and finish. For blue-green use more indigo extract. Darker or lighter shades are dyed by using more or less in proportion of each ingredient.

277. Green. Work for 40 minutes in a decoction of 4 pounds fustic; lift, and add 1 pound alum in solution, and 2 fluid ounces indigo extract (*see No.* 99); work in this for 30 minutes, wash out in cold water containing ½ pint alum solution, and finish.

278. Pea Green. Steep for an hour in a solution of 8 ounces alum to the gallon of water, then wash out in warm water; boil 4 pounds ebony wood chips for an hour; take the clear liquor and work the silk in it for 30 minutes; lift, and add ½ fluid ounce indigo extract (*see No.* 99); work for 10 minutes; wash in cold water containing ½ pint alum solution, and dry.

The indigo extract must be added with caution, as too much will make the green too blue; it is safer to add less, and then, if necessary, lift, and add more.

279. Bottle Green. Work for an hour in a solution of 2 pounds alum and 1 pound copperas; wash out in warm water, then work for 30 minutes in a decoction of 6 pounds fustic; lift, and add 2 fluid ounces indigo extract (*see No.* 99); work for 20 minutes, wash out and finish.

280. Bottle Green. Proceed exactly as for *common green* (*see No.* 276) with the addition of 1 pound logwood to the 6 pounds fustic. The addition of a little more logwood makes a still deeper shade if required.

281. Olive. Work the silk for 30 minutes in a solution of 1 pound copperas and 4 ounces alum; wash out in hot water, then work for 30 minutes in a decoction of 2 pounds fustic and 4 ounces logwood; lift, and add 2 ounces alum in solution; work 10 minutes, wash and dry.

A little chemic (*see No.* 162) added to the last wash water will induce a greener hue if required.

282. Light Olive. Dye a light Prussian blue (*see No.* 256); then work for 20 minutes in a decoction of 2 pounds fustic and ½ pint archil liquor; lift, and add 1 ounce alum in solution; work 10 minutes and finish.

283. To Dye Mixed Fabrics Two Colors. Mixed fabrics of cotton and wool, such as coburgs, damasks, &c., may be dyed all of one color, or the cotton and wool in them each dyed a different color. This is seldom done except with new goods, or with very light colored goods which are desired to be dyed dark colors. As the process for dyeing woolens will seldom impart the same color to cottons, the two are dyed separately, and the method is quite simple. For most colors it is necessary to dye the woolen portion first, and then the cotton; but in a few cases the cotton must be the first to be acted on.

284. Green and Pink. First dye the woolen *green* by either of the methods given in Nos. 206, 207, &c. The cotton is then dyed pink, according to receipt No. 248.

285. Green and Crimson. Dye the woolen by working for an hour in 2 pounds tartar, 4 pounds alum, and 6 pounds fustic; lift, and add ½ pint indigo extract (*see No.* 99); wash out, and lay over night in 6 pounds sumach; then work for 30 minutes in red spirits (*see No.* 108) made to a strength of 1½° Baumé; wash out, and work for an hour in 5 pounds peachwood at blood heat; lift, and add a little alum; work in this, then wash out and finish.

286. Blue and Orange. First dye the cotton by the blue vat (*see No.* 130), wash out, and then dye the woolen by working an hour in a bath made up of 2 pounds tartar, 8 ounces cochineal, 2 pounds fustic, and 2 pints bichloride of tin; wash and dry.

In this way almost any two colors may be dyed upon woolen and cotton, although woven together, by proceeding according to the receipt for the color required on each sort of fibre. The wool is always dyed first, excepting in the case where the cotton is dyed in the blue vat, when the cotton has to be treated first. The same principle is applicable to silk and woolen fabrics, although in many cases the silk becomes more imbued than the cotton by the woolen dyes. A mixture of silk and cotton can be dyed in the same manner, but it is much more difficult, and cannot be done with all kinds of colors, and the process is seldom resorted to. But the intelligent dyer will be able to combine a variety of tints by following the rules and receipts given.

287. To Dye Mixed Fabrics one Color. If the mixed fabrics are required to be dyed one uniform color, the double process has often to be adopted, especially for cotton and woolen fabrics, thus:

288. Black on Cotton and Woolen

Goods. First dye the woolen according to No. 192; then, after steeping the goods in sumach, dye the cotton by receipt No. 139.

289. **Brown on Cotton and Woolen Goods by one Process.** Work for 2 hours in catechu, as in No. 147; then work at a boiling heat for an hour with 8 ounces bichromate of potassa and 2 ounces tartar; next work for an hour in 2 pounds fustic and 8 ounces cudbear; wash and dry. For a deeper shade, or of a more chocolate hue, add 4 ounces logwood to the cudbear.

290. **Black on Silk and Woolens by one Process.** Work for an hour in a solution of 8 ounces tartar and 8 ounces copperas; wash out, then work for 15 minutes in a decoction of 4 pounds logwood; lift, and add 1 ounce chrome; work for 30 minutes and dry.

291. **Black on Cotton, Silk and Wool, by one Process.** Steep for 6 hours in 2 pounds sumach; then work for an hour in a solution of 6 ounces tartar, 6 ounces sulphate of copper, and 6 ounces copperas; wash out, and then work for half an hour in a decoction of 4 pounds logwood; lift, and add 1 ounce copperas; work for 10 minutes, wash and dry.

292. **Deep Black.** To obtain a very deep black, add 1 pound of bark to the logwood, and proceed as in last receipt.

293. **Drabs on Cotton, Silk and Wool, by one Process.** Work for half an hour in 8 ounces copperas and 4 ounces tartar; lift and drain; then work for half an hour in 4 ounces logwood and 1 ounce bichromate of potassa; wash out and dry. By varying the quantity of logwood, and by introducing a little fustic or peachwood in combination with the logwood, a great variety of drabs, slates or fawns can be produced.

These few receipts for mixed fabrics will show the care required in such operations, although, by practice, they become comparatively simple.

294. **To Detect Animal or Vegetable Fibres.** Treat the fabric with bichloride of tin heated to from 130° to 150° Fahr., when the cotton and linen become black, and the wool and silk remain unchanged.

295. **To Detect Mixed Fabrics of Cotton and Wool.** Dip a piece of the cloth in bleaching liquor; after a little while the woolen turns yellow, and the cotton white, and may easily be distinguished.

296. **To Detect Cotton in Linen.** The piece to be tested should be boiled to remove all dressing, and then dried; put a portion of the piece into common vitriol for about one minute; take it out and wash it in water several times, and then into a weak solution of soda or potash, and all the gummy matter formed is removed by gentle rubbing. By this process the cotton is dissolved and the linen remains, or any portion of the cotton that is not dissolved becomes opaque white, while the linen is transparent. By comparing the portion thus tested, with a similar portion not tried, the quantity of cotton present can easily be estimated.

297. **To Detect Cotton in Linen.** Take a small piece of the cloth, boil in water and dry; then take 3 parts, by weight, of sulphuric acid, and 2 parts of crushed nitrate of potassa; put the dry piece of cloth in this mixture for 6 or 7 minutes, and then wash it in water until there is no taste of acid; dry it at a gentle heat; next put it into a mixture of ether and alcohol, which will dissolve the cotton and not the linen. If the piece be weighed before and after putting it into the ether and alcohol, the quantity of cotton in the fabric can be accurately ascertained.

298. **To Distinguish Cotton and Wool.** Take a small piece of the cloth and boil in caustic soda; the wool will be dissolved, and the cotton remain. If the threads have been previously counted, their relative mixture can be found.

299. **To Detect Cotton with Silk or Wool.** Put a piece of the cloth into chlorine water or bleaching liquor. The cotton is whitened, and the silk and wool turn yellow, and can easily be distinguished by the aid of a pocket lens.

300. **To Detect Cotton in Silk or Wool.** Take a small piece and unravel the threads, and inflame them; the cotton burns away freely and leaves little or no black charcoal; the wool and silk shrivel up, leave a black charcoal, and give a strong smell.

Decidedly the best and safest method, and one applicable in all cases, is a microscopic examination, by which not only the structure, but also the nature of the fibre can be demonstrated. Cotton, wool and silk are easily distinguished by the microscope, as they differ materially in appearance. Cotton forms flat, narrow ribbons, curled up in spirals like those of a corkscrew; wool fibre is stouter than all others, and may be recognized by its scaly surface, while silk is the thinnest fibre, has the smoothest surface, and possesses the least structure. These appearances are very characteristic, and any one who has observed them once will ever afterwards recognize them again at first sight.

301. **To Distinguish Silk and Wool in Fabrics.** Silk can always be identified in a mixture with any other animal or vegetable fibre by means of concentrated hydrochloric acid, which dissolves it completely and immediately, without appreciably affecting any woolen or woody fibre with which the silk may have been interwoven. Strong sulphuric acid has also a powerful solvent effect upon silk, and is likewise much more destructive in its action upon cotton than the other acid. Should it be desired to determine the nature of any fibres remaining after the solution of the silk, it is first necessary to wash and collect them, when they will usually be found destitute of color. To decide whether wool is present or absent, a solution of picric acid may be employed, which instantly imparts a full yellow tint to the wool, but does not in the least affect cotton, linen, or China grass; so that it is only necessary to immerse the fabric in the dye, wring it out, and wash well with water. Should any portion remain of a yellow color, the presence of wool is indicated. Other methods can be employed similar in principle, but the picric acid is believed to be best. Discrimination between the different kinds of fibre can best be prosecuted by means of the microscope, but their quantity is best found by dissolving away one fibre, as already directed, and weighing.

Family Dyeing Receipts.

The following receipts and directions are excellent for dyeing on a small scale, and especially adapted for family use. The ingredients required can be obtained at any color store.

303. Black for Worsted or Woolen. Dissolve ¾ ounce bichromate of potash in 3 gallons water. Boil the goods in this 40 minutes; then wash in cold water. Then take 3 gallons water, add 9 ounces logwood, 3 ounces fustic, and one or two drops, D. O. V., or Double Oil of Vitriol; boil the goods 40 minutes, and wash out in cold water. This will dye from 1 to 2 pounds of cloth, or a lady's dress, if of a dark color, as brown, claret, &c.

All colored dresses with cotton warps should be previously steeped 1 hour in sumach liquor; and then soaked for 30 minutes in 3 gallons of clean water, with 1 cupful of nitrate of iron (*see No.* 116); then it must be well washed, and dyed as first stated.

304. Black for Silk. Dye the same as black for worsted; but previously steep the silk in the following liquor: scald 4 ounces logwood, and ¼ ounce turmeric in 1 pint boiling water; then add 7 pints cold water. Steep 30 or 40 minutes; take out, and add 1 ounce sulphate of iron (copperas), dissolved in hot water; steep the silk 30 minutes longer.

305. Brown for Worsted or Wool. Water, 3 gallons; bichromate of potash, ¾ ounce. Boil the goods in this 40 minutes; wash out in cold water. Then take 3 gallons water, 6 ounces peachwood, and 2 ounces turmeric. Boil the goods in this 40 minutes; wash out.

306. Imperial Blue for Silk, Wool, and Worsted. Water, 1 gallon; sulphuric acid, a wine-glassful; imperial blue, 1 tablespoonful or more, according to the shade required. Put in the silk, worsted, or wool, and boil 10 minutes; wash in a weak solution of soap lather.

307. Sky Blue for Worsted and Woolen. Water, 1 gallon; sulphuric acid, a wine-glassful; glauber salts in crystals, 2 tablespoonfuls; liquid extract of indigo, 1 teaspoonful. Boil the goods about 15 minutes; rinse in cold water.

308. Claret for Wool or Worsted. A Short Way of Dyeing the Same. Water, 3 gallons; cudbear, 12 ounces; logwood, 4 ounces; old fustic, 4 ounces; alum, ½ ounce. Boil the goods in it 1 hour. Wash. This will dye from 1 to 2 pounds of material.

309. Crimson for Worsted or Wool. Water, 3 gallons; paste cochineal, 1 ounce; cream of tartar, 1 ounce; nitrate of tin (*see No.* 113), a wine-glassful. Boil your goods in this 1 hour. Wash first in cold water, then in another vessel with 3 gallons warm water with a cupful of ammonia, the whole well mixed. Put in the goods and work well 15 minutes. For a bluer shade add more ammonia. Then wash out.

310. Fawn Drab for Silk. Hot water, 1 gallon; annotto liquor (*see No.* 95), 1 wine-glassful; 2 ounces each of sumach and fustic. Add copperas liquor according to the required shade. Wash out. It is best to use the copperas liquor in another vessel, diluted according to the shade desired.

311. Dark Drab for Silk may be obtained by using a little archil and extract of indigo.

312. Flesh Color for Dyeing Silk. Boiling water, 1 gallon; put in 1 ounce white soap, and 1 ounce pearlash. Mix well, then add a cupful of annotto liquor. (*See No.* 95.) Put the silk through several times, and proportion the liquor till you obtain the required shade.

313. Salmon Color for Silk may be obtained by first passing through the above liquor, and then through diluted muriate of tin. (*See No.* 113.)

314. Magenta for Silk, Wool or Worsted. Water, 1 gallon, heated up to 180 degrees; and magenta liquor, 1 tablespoonful; stir it well up. This will dye a broad ribbon 4 yards long, or a pair of small stockings. To dye a larger quantity of material, add more magenta liquor and water. The shade of color may be easily regulated by using more or less. Magenta Pink may be obtained by increased dilution.

315. Mauve for Silk, Wool or Worsted. Water, 1 gallon; add 1 table-spoonful sulphuric acid; then heat to boiling point. For a *very light mauve*, add 1 tea-spoonful imperial violet liquor; boil the same amount of material, as stated under Magenta, about 10 minutes. Rinse in cold water. If the color be too deep, use a little soap in rinsing, using warm water.

316. Violet Color for Worsted may be produced by using a table-spoonful of violet liquor instead of a tea-spoonful.

317. Pea Green for Silk. To 1 quart water, put ½ tea-spoonful picric acid, and rather more than ½ wine-glassful sulphuric acid, and a tea-spoonful paste extract of indigo; boil about 5 minutes, then add water to cool it down to blood heat, or 100° Fahr. Put in the silk, and work it about 20 minutes. The shade may be varied by adding more or less of the picric acid, or extract of indigo; if more of either be added, boil separately in a little water, and add to the previous liquor.

318. Pea Green for Worsted. Use the same materials as the aforesaid; but boil all the time in 1 gallon of water for about 20 or 30 minutes.

319. Dark Green for Worsted. This may be obtained by using a larger quantity of material, in the same way as the last.

320. Plum Color for Worsted, Silk or Cotton. Water, 1 gallon; sulphuric acid, 1 tea-spoonful; glauber salts, in crystals, 2 table-spoonfuls; violet liquor, 1 table-spoonful; magenta liquor, ½ table-spoonful. Boil the article (silk, wool or worsted), about 10 minutes.

321. Remarks on Dyeing Cotton. Cotton should be dyed the above colors separately, and by first running them through weak gall liquor, and weak double muriate of tin. Then wash well, and work in the aforesaid liquor, according to color and shade. The dyeing liquor should be cold.

322. Scarlet on Worsted or Wool. 3 gallons water, 2 ounces dry cochineal, 1 ounce cream of tartar, 1 wine-glassful nitrate of tin; boil the goods 1 hour. To give the goods a yellower hue, add a little young fustic to the above mixture. Wash out as before.

323. Yellow for Dyeing Silk. Proceed the same as in dyeing pea green, omitting the extract of indigo, and using oxalic tin instead of sulphuric acid.

324. To Dye Feathers. First steep them a few hours in warm water.

325. Blue may be dyed by extract of indigo and boiling water. Simmer over the fire a few minutes.

326. Green. Verdigris and verditer, 1 ounce each; and gum water. Dip the feathers. Or mix the indigo liquor with Persian berry liquor.

327. Lilac. Use cudbear and hot water.

328. Red. Brazil wood, a little vermilion and alum, and vinegar. Boil 30 minutes, and then dip the feathers.

329. Yellow, by turmeric.

330. Scarlet, by cochineal, cream of tartar, and muriate of tin. (*See No.* 113.)

331. To Dye Dove or Slate Color. Boil a teacup of black tea in an iron pot, adding a tea-spoonful of copperas. The depth of color will depend on the quantity of water used. Dye the articles in this and then hang them up to drain, finally rinsing out in soapsuds.

332. Aniline Red. This produces a color varying from the deepest crimson to a very brilliant and beautiful rose pink, according to the strength of the dye. All that is necessary is to enclose the aniline in a small muslin bag, and having a kettle (tin or brass) filled with moderately hot water, rub the substance out. Then immerse the articles to be colored, and in a short time they are done. The dye is so readily absorbed that care is required to prevent spotting. No mordant is required, although it improves the color to wring the goods out of strong soapsuds before putting them in the dye. This is a permanent color for woolen or silk.

333. Aniline Blue. To 100 pounds of fabric dissolve 1¼ pounds aniline blue in 3 quarts hot alcohol; strain through a filter and add it to a bath of 130° Fah.; also 10 pounds glauber salts, and 5 pounds acetic acid. Enter the goods and handle them well for 20 minutes; next heat it slowly to 200° Fah.; then add 5 pounds sulphuric acid diluted with water. Let the whole boil 20 minutes longer, then rinse and dry. If the aniline be added in two or three proportions during the process of coloring, it will facilitate the evenness of the color. Hard and close wove fabrics, such as braid, ought to be prepared in a boiling solution of 10 pounds sulphuric acid and 2 pounds tartaric acid before coloring with the aniline, as this will make the fabric more susceptible to the color.

334. To Dye Hats. A bath for dyeing 12 dozen hats consists of 144 pounds logwood, 12 pounds green sulphate of iron or copperas, 7½ pounds verdigris. The copper is made of a semi-cylindrical shape, and should be surrounded with an iron jacket, or case, into which steam may be admitted, so as to raise the temperature of the interior bath to 190° Fah., but no higher; otherwise the heat is apt to affect the stiffening varnish, called the gum, with which the body of the hat has been imbued. The logwood having been introduced and digested for some time, the copperas and verdigris are added in successive quantities, and in the above proportions, along with every successive two or three dozen of hats suspended upon the dipping machine. Each set of hats, after being exposed to the bath, with occasional airings, during 40 minutes, is taken off the pegs, and laid out upon the ground to be more completely blackened by the peroxydizement of the iron with the atmospheric oxygen. In 3 or 4 hours the dyeing is completed. When fully dyed, the hats are well washed in running water.

335. Spirit Stiffening for Hats. 7 pounds orange shellac; 2 pounds gum sandarac; 4 ounces gum mastic; ½ pound amber resin; 1 pint solution of copal; 1 gallon spirit of wine, or wood naphtha.

The shellac, sandarac, mastic, and resin are dissolved in the spirit, and the solution of copal is added last.

336. Alkali Stiffening for Hats. 7 pounds common block shellac; 1 pound amber resin; 4 ounces gum thus; 4 ounces gum mastic; 6 ounces borax; ½ pint solution of copal.

The borax is first dissolved in about 1 gallon warm water. This alkaline liquor is put into a copper pan (heated by steam), together with the shellac, resin, thus, and mastic, and allowed to boil for some time, more warm water being added occasionally until it is of a proper consistence; this may be known by pouring a little on a cold slab, somewhat inclined, and if the liquor runs off at the lower end, it is sufficiently fluid. If, on the contrary, it sets before it reaches the bottom, it requires more water. When the whole of the gums seem dissolved, ½ pint of wood naphtha must be introduced, with the solution of copal; then the liquor must be passed through a fine sieve, and it will be perfectly clear and ready for use. This stiffening is used hot. The hat bodies, before they are stiffened, should be steeped in a weak solution of soda in water, to destroy any acid that may have been left in them (as sulphuric acid is used in the making of the bodies.) If this is not attended to, should the hat body contain any acid when it is dipped into the stiffening, the alkali is neutralized, and the gums consequently precipitated. After the body has been steeped in the alkaline solution, it must be perfectly dried in the stove before the stiffening is applied; when stiffened and stoved, it must be steeped all night in water to which a small quantity of the sulphuric acid has been added; this *sets* the stiffening in the hat body, and finishes the process.

To Remove Stains, Spots, &c.

The following receipts embrace directions for cleaning, and removing stains of every kind, from clothing, linen, etc., and articles pertaining to the household. Receipts for cleansing other articles will be found elsewhere under their appropriate headings.

338. To Remove Resin Spots from Silk. Stains by wax, resin, turpentine, pitch, and substances of a resinous nature, may be removed by pure *alcohol.* It frequently happens that when common turpentine is employed to remove grease, varnish or paint stains from silk, the turpentine itself leaves a stain almost as objectionable as the original one, which it was used to remove. These stains are due to the resin which is held in solution by the turpentine, and which remains in the silk after the volatile or spirituous portion has evaporated. Alcohol applied to the stains with a clean sponge will remove the spots, because alcohol dissolves the resin. The silk stains should be moistened with the alcohol first, and allowed to remain soaked for a few minutes. Fresh alcohol is then applied with the sponge, and with a slight rubbing motion. It is then wiped as dry as possible and afterward permitted to dry perfectly in the open air.

339. To Remove Pitch, Varnish, or Oil-paint Stains. When pitch, varnish, or oil-paint stains have become dry, they should be softened with a little butter or lard, before using turpentine and soap. In these cases, a simple way is to soak the part in spirits of turpentine, and, when softened, to wash it off with the same fluid. *Burning-fluid* combines the solvent powers of both alcohol and turpentine. Benzine is also good. Chloroform will also remove paint from a garment when almost everything else fails. The fats, resins, and unctuous oils, are dissolved by *essential* oils, as *oil of turpentine.* Common spirits of turpentine, however, requires to be purified by re-distillation, or it will leave a resinous stain upon the spot where it is used. (*See last receipt.*)

340. To Remove Paint Stains from Clothes. Chloroform is an excellent medium for the removal of stains of paint from clothes, etc. It is found that portions of dry white paint, which resisted the action of ether, benzole, and bisulphide of carbon, are at once dissolved by chloroform. If the paint is fresh, turpentine or alcohol will remove it. (*See No.* 338.)

341. To Remove Wax Stains from Silk. Mix powdered French chalk with lavender water to the thickness of mustard. Put it on the stain, and rub it gently with the finger or palm of the hand. Put a sheet of clean blotting paper and brown paper over it, and smooth it with a warm iron. When dry the chalk must be removed, and the silk gently dusted with a white handkerchief. If a faint mark still remains, a second application of French chalk and lavender water will generally remove it. If the wax stain has fallen thickly on the silk, it should be removed first carefully with a penknife.

342. To Remove Wax Spots from Cloth. Remove, by scraping with a knife, as much of the wax as you can without injury to the fabric; drop benzine on the spot, then with a sponge rub it gently; repeat it till the spot disappears.

343. To Remove Spermaceti, or Stearine Stains. To remove spots of spermaceti, scrape off as much as you can with a knife, then lay a thin, soft, white blotting paper upon the spots, and press it with a warm iron. By repeating this you will draw out the spermaceti. Afterwards rub the cloth where the spots have been, with some very soft brownish paper.

344. To Remove Grease Spots. To do this without injury to the color of the fabric, is sometimes easy, frequently most difficult, and often impossible. Much may depend upon skillful and persevering manipulation; and although various agents are oftentimes valuable, yet good soap, after all, is the chief reliance. Grease spots may generally be removed by the patient application of soap and soft water, but other means are also employed. Ox-gall is an excellent and delicate cleansing agent. It is a liquid soda soap. It removes grease, and is said to fix and brighten colors, though it has a greenish tinge, which is bad for the purity of white articles. Aqua ammonia is also good for removing grease spots from any fabric. Use the ammonia nearly pure, and then lay white blotting paper over the spot and iron it lightly. (*See also No.* 126.)

345. To Remove Grease and Dirt from Cloth and Woolen Articles. Place a cotton or woolen cloth, or a piece of blotting paper, under the article to be cleansed, then rub upon the spots some pure benzine, and the grease or dirt will disappear as if by magic.

Be sure to place a cloth under the garment to be operated upon, otherwise a circular stain will remain, which cannot be removed. The benzine drives the grease through the article to be cleaned, and is absorbed by the cloth placed under it. After the spot is removed, continue to rub with a dry cloth until the benzine is evaporated; this also is done to avoid a stain.

346. Cautions about Benzine. From the facility with which it removes grease spots from fabrics, this substance has come to be regarded almost as a household indispensable. But few persons, however, realize the explosive character of benzine or the dangers attending the careless handling of the liquid. Being one of the most volatile and inflammable products resulting from the distillation of petroleum, it vaporizes with great rapidity, so that the contents of a 4 ounce vial, if overturned, would render the air of a moderate sized room highly explosive. The greatest care should be exercised in handling this substance, in proximity to fire, and it is important to remember that the vapor escaping from an uncorked bottle will cause a flame to leap over a space of several feet.

347. To Remove Grease from Cloth. Take 1 quart lime; add thereto as much water as will dissolve the lime and leave about 1 quart clear water after it has been well stirred and settled. Let it stand about two hours, and then pour off the clear liquid into another vessel. Now add to it ½ an ounce of pearlash; stir it well, and, when settled, bottle it for use. This liquor is to be diluted with water, to suit the strength or delicacy of the color of the cloth. It is applied with a piece of coarse sponge, rubbing out the grease, and applying clear water afterwards.

This is one of the best receipts known for the extraction of grease; but it is destructive to certain vegetable colors.

348. To Remove Grease Spots from Cloth. Soft soap, and fuller's earth, of each ½ pound; beat well together in a mortar, and form into cakes. The spot, first moistened with water, is rubbed with a cake, and allowed to dry, when it is well rubbed with a little warm water, and rinsed or rubbed off clean.

349. Scouring Balls. Dry fuller's earth, moistened with the juice of lemons; add a small quantity of pearl ashes, and a little soft soap; knead the whole well together into a thick elastic paste; form it into small balls and dry them in the sun. When used, moisten the spot on the clothes with water; then rub it with the ball, and let the spot dry in the sun. When washed with pure water the spot will disappear.

350. To Remove Grease from Cloth or Silk. Separate the yolk of an egg from the white as perfectly as possible. Then stretch the fabric on a board, and with a soft clothes brush dip into the yolk, and rub the spot with it until the grease seems loosened. The yolk will not injure the most delicate colors, but the rubbing may, if too severe. Then rinse with warm rain water, rubbing the edges with a damp cloth, and clapping the whole between dry towels. If the stain is not quite gone, repeat the process. It will not do so well for fabrics mixed with cotton or linen.

351. To Remove Grease from Silk or Velvet. Rub the spots on the silk *lightly* and *rapidly* with a clean soft cotton rag dipped in chloroform, and the grease will immediately disappear without injuring the color of the silk. Repeat the operation if necessary. Be careful to rub the article rapidly and lightly, then finish with a clean dry cloth. If these precautions are not taken, a slight stain is apt to be the result. Very highly *rectified* benzine, such as is prepared by the first-class druggists, will also immediately remove grease from the most delicate colored silks.

352. To Remove Grease from Silk. Take French chalk finely scraped, and put it on the grease spot, holding it near the fire, or over a warm iron reversed, or on a water-plate in which is boiling water. This will cause the grease to melt, and the French chalk will absorb it, and it may then be brushed or rubbed off; or, put a little powdered French chalk on the spot, cover it with a piece of white blotting-paper, and over that a piece of brown wrapping paper, and apply a hot flat-iron. If any grease remains, proceed as before, until it is all extracted. The French chalk is a fine soluble powder of a dry absorbent quality, acting upon silks the same as fuller's earth does upon cloth.

The above plans may be adopted when you desire to extract the grease immediately; but if time is not an object, proceed as follows:

Sprinkle pulverized French chalk upon the spot and put the article in a dark place, and in a few days the grease will entirely disappear. We think this last method the best, as the heat from the iron will sometimes injure silk of a delicate tint.

353. To Remove Grease Spots from Silk. Grease spots may be taken from silks in the following manner: Upon a wooden table lay a piece of woolen cloth or baize, upon which lay smoothly the part stained, with the right side downwards. Having spread a piece of brown paper on the top, apply a flat-iron just hot enough to scorch the paper. About five or eight seconds is usually sufficient. Repeat until the spot is extracted. Then rub briskly with a piece of writing paper. (*See last receipt.*)

354. French Scouring Drops for Removing Grease. Camphene, 8 ounces; pure alcohol, 1 ounce sulphuric ether, 1 ounce; essence of lemon, 1 drachm; or, spirits of wine, 1 pint; white soap, 3 ounces; ox gall, 3 ounces; essence of lemon, ¼ ounce.

355. To Remove Grease from Velvet. Grease may be taken out of velvet by a little turpentine, poured over the spot; then rub briskly with a piece of clean dry flannel. Repeat the application, if necessary, and hang the article in the air, to remove the smell. (*See No.* 351.)

356. Simple Method of Removing Grease Spots from Silk. Take a visiting or other card; separate it, and rub the spot with the soft internal part, and it will disappear without taking the gloss off the silk. This is a simple and valuable receipt. Be careful and rub the silk on the *wrong side*, as the card sometimes will soil delicate colored silks, but if the above precaution is taken, the spot cannot be seen on the right side of the silk.

357. To Remove Oil from Carpets. To take oil out of a carpet, as soon as it is spilled put on plenty of wheat flour or whiting, to absorb the oil and keep it from spreading. If the oil is near a seam, rip it, so that the spot will not spread, and put whiting on the floor under the carpet. Next day sweep up all the flour above and under the carpet with a stiff brush, and put on plenty of fresh flour. To take out grease spots, rub them with white flannel dipped in raw spirits of turpentine. If they show after a while, rub again on both sides. If there are grease spots on the floor, remove them with potter's clay before the carpet is laid down.

358. To take Grease Spots out of Carpets. Mix a little soap into a gallon of warm soft water, then add ½ ounce of borax; wash the part well with a clean cloth, and the grease or dirty spot will soon disappear.

359. To Remove Oil Stains from Leather and Paper. Oil stains may be removed from leather, paper, &c., by applying pipe-clay, powdered and mixed with water to the thickness of cream; leave it on for four hours. This will not injure the best colors.

360. Methods of Removing Various Stains. Fruit-stains, wine-stains, and those made by colored vegetable juices, are often nearly indelible, and require various treatment. Thorough rubbing with soap and soft water; repeated dipping in sour butter-milk, and drying in the sun; rubbing on a thick mixture of starch and cold water, and exposing long to sun and air, are among the expedients resorted to. Sulphurous acid is often employed to bleach out colors. It may be generated at the moment of using, by burning a small piece of sulphur in the air, under the wide end of a small paper funnel, whose upper orifice is applied near the cloth. Coffee and chocolate stains require careful soaping and washing with water at 120°, followed by sulphuration. If discoloration has been produced by acids, water of ammonia should be applied; if spots have been made by alkaline substances, moderately strong vinegar may be applied; if upon a delicate article, the vinegar should be decolorized by filtering through powdered charcoal.

361. The Effects of Acids and Alkalies upon Different Colors. The effect of acids upon blacks, purples, blues (except those produced by indigo or Prussian blue), and upon all those shades of colors which are produced by means of iron, archil, and astringent substances, is to turn them red. They render yellows more pale, except those produced by annotto, which they turn to an orange color.

Alkalies turn scarlets, and all reds produced by Brazil or logwood, to a violet color; they turn green (upon woolen cloths) to yellow, and they give a reddish cast to the yellow produced by annotto. The effect of the perspiration is the same as that of the alkalies.

Spots occasioned by acids are removed by alkalies, and *vice versâ*. (*See last receipt.*)

362. To Restore Colors that have been Injured by the use of Re-Agents. The colors of cloths are often injured by the re-agents made use of in order to restore them effectively; when such is the case we must not only understand the general principles of the art of dyeing, but the nature and composition of the particular dye that was originally employed for dyeing the cloth whose color is to be restored, and thus enabled to modify the means accordingly. Thus, when, after using an alkali to remove an acid spot upon brown, violet, or blue cloth, &c., there remains a yellow spot, the original color is again produced by means of a solution of tin. A solution of the sulphate of iron restores the color to those brown cloths which have been dyed with galls. Acids give to yellow cloths which have been rendered dull or brown by alkalies, their original brightness. When black cloths dyed with logwood have any reddish spots occasioned by acids, alkalies turn such spots to a yellow color, and a little of the astringent principle makes them black again. A solution of 1 part of indigo in 4 parts of sulphuric acid, properly diluted with water, may be successfully employed to restore a faded blue color upon wool or cotton. Red or scarlet colors may be restored by means of cochineal, and a solution of muriate of tin, &c. (*See No.* 113.)

363. The Choice of Re-Agents for Restoring Color. The choice of re-agents is not a matter of indifference; vegetable acid (*Decolorized Vinegar, see Index*), is generally preferable to mineral acids. The sulphurous acid (*see No.* 360), however, may be used for spots from fruit; it does not injure blue upon silk, or the colors produced by astringents; nor does it affect yellow upon cotton. A volatile alkali (*Water of Ammonia*) succeeds better than a fixed alkali in removing spots produced by acids. They are usually made use of in the form of vapor, and act quickly, seldom injuring the color of the cloth.

364. To Remove Fruit Stains. Spots caused by fruit are removed by sulphurous acid, or what is still better, by water acidulated with a little muriatic or oxalic acid, or salt of lemons; but care must be taken not to apply this liquid to colors that it will injure. A lighted sulphur match held under the stain will produce sufficient sulphurous acid.

365. To Remove Fruit and other Stains from Linen. Fruit and other spots on linen may be removed by applying to the part, previously washed clean, a weak solution of chlorine, chloride of lime, spirits of salts (muriatic acid), oxalic acid, or salts of lemon, in warm water, and frequently by merely using a little lemon juice. The part should be again thoroughly rinsed in clear warm water (without soap), and dried.

Many other stains may be taken out by dipping the linen in sour butter-milk, and drying it in a hot sun. Then wash it in cold water, and dry it, 2 or 3 times a day.

366. To Remove Acid Stains from Linen, &c. These may be removed by the following methods: Wet the part and lay on it some salt of wormwood (*carbonate of potassa*); then rub it, without diluting it with more water.

Or: Tie up in the stained part some pearl-ash; then scrape some soap into cold soft water to make a lather, and boil the linen till the stain disappears.

367. To Remove Acid Stains from Garments. Chloroform will restore the color of garments, where the same has been destroyed by acids.

When acid has accidentally or otherwise destroyed or changed the color of the fabric, ammonia should be applied to neutralize the acid. A subsequent application of chloroform restores the original color.

Spots produced by hydrochloric or sulphuric acid can be removed by the application of concentrated ammonia, while spots from nitric acid can scarcely be obliterated.

368. To Remove Alkali Stains from Garments. Spots produced by alkalies, such as soap-boiler's lye, soda, ammonia, etc., can generally be made to disappear completely by the prompt application of dilute acetic acid and a good deal of water. (*See No.* 360.)

369. To Remove Claret or Port Wine Stains. Apply a little table salt to the spot stained, and also moisten it with sherry. After washing, no trace of the stain will be left. The acid contained in claret decomposes the salt, and sets free chlorine (bleaching gas), which removes the vegetable coloring matter of the wine. If the stain is from port, sherry should be added, as it also contains acid.

370. To Remove Stains of Wine, Fruit, &c., after they have been long in the Linen. Rub the part on each side with yellow soap; then lay on a mixture of starch in cold water very thick; rub it well in, and expose the linen to the sun and air till the stain comes out. If not removed in 3 or 4 days, rub that off and renew the process. When dry it may be sprinkled with a little water.

371. To Remove Stains of Iodine. Stains of iodine are removed by *rectified* spirit.

372. To take out all Stains which are not Metallic. Mix 2 tea-spoonfuls of water with one of spirit of salt (muriatic acid); let the stain lie in it for one or two minutes; then rinse the article in cold water. This will be found particularly useful in removing stains from white napkins.

373. Prepared Ox-gall for taking out Spots. Boil together 1 pint of ox-gall and 2 ounces powdered alum; to which add 2 ounces common salt; let the liquor settle;

add a few drops essence of lemon, pour it off into a bottle, and cork tightly.

374. Scouring Balls for General Purposes. In order to remove a stain, the cause or origin of which is doubtful, a composition is requisite which possesses various powers. The following is a good one for such purposes: Dissolve some white soap in alcohol, and mix with it the yolks of 4 or 5 eggs; add gradually a little spirits of turpentine, and sufficient fuller's earth to make the mixture into balls. To remove a stain, wet the spot with soft water, rub it with a ball of the above composition, then rub the cloth and wash out. This will remove almost any stain, except ink and other solutions of iron.

375. To Remove Iron Mould or Ink Stains. For iron mould or ink stains, lemon juice or salt of sorrel (oxalate of potash) may be used. If the stains are of long standing, it may be necessary to use oxalic acid, which is much more powerful. It may be applied in powder upon the spot, previously moistened with water well rubbed on, and then washed off with pure water. It should be effectually washed out, for it is highly corrosive to textile fibres. (*See also No.* 127.)

376. To Remove Iron Mould. The part stained should be remoistened with ink, and this removed by the use of muriatic acid diluted with 5 or 6 times its weight of water, when it will be found that the old and new stain will be removed simultaneously. This is a very effectual method.

377. To Remove Stains of Iron Mould from Fabrics. The removal of these stains is a matter of some difficulty if they have remained on a fabric for some time. The usual substances employed for this purpose (oxalic acid or quadroxalate of potassa) require placing, in concentrated solution, in contact with the material for a considerable time, thereby materially weakening and rotting the fibre. The following method is free from this objection, and will remove stains of long standing almost immediately: Wet the mark with yellow sulphide of ammonium, by which it will be immediately blackened, and allow it a minute or so to penetrate; then wash out the excess of sulphide, and treat the black spot with cold dilute muriatic acid, by which it is immediately removed. Finally, wash well with water.

378. To Make Essential Salt of Lemons, for removing iron moulds, ink spots, and stains from linen and cotton. Take 1 ounce of oxalic acid in fine powder, mix with 4 ounces of cream tartar, and put it up in small oval boxes.

379. To Remove Ink, Iron Mould, &c., from Linen. Wet the finger in water, dip it in the powder (*see last receipt*), and rub it on the spot gently, keeping it rather moist, and the stain will disappear without injuring the fabric. After the stain disappears, wash the linen in pure water. The salt of lemon used as a beverage is simply tartaric acid, put up in long bottles. The above is poisonous if swallowed.

380. To Remove Iron Mould and Ink from Delicate Linen Fabrics. These may be taken out by wetting the spots in milk, then covering them with common salt. It should be done before the garments have been washed. Another way to take out ink is to dip it in melted tallow. For fine, delicate articles, this is the best way.

381. To take out Mildew Spots. Wet the spots with a solution of chloride of soda (Labarraque's solution), or of chloride of lime (bleaching fluid), or with chlorine water, and they will disappear immediately. Fruit and wine stains of all kinds may be removed in this way. (*See also No.* 128.) Starched linen which has contracted mildew spots will require an application each day for 2 or 3 days; rinsing out and bleaching in the sunshine after each application.

382. To Remove Mildew. Mildew is easily removed by rubbing or scraping a little common yellow soap on the article, and then a little salt and starch on that. Rub all well on the article, and put in the sunshine. Or, soap the linen previously wetted, and apply salt and lemon juice to both sides; or apply finely powdered pipe clay, or fuller's earth, or finely powdered chalk. Expose it for several hours to the atmosphere.

383. To Extract Mildew. Mix soft soap with powdered starch, half as much salt, and the juice of a lemon, and lay on with a brush. Let it lay on the grass day and night till the stain is gone. This is a good receipt. Or, take 2 ounces chloride of lime, pour on it a quart of boiling water, then add 3 quarts of cold water; steep the linen 10 or 12 hours, when every spot will be extracted.

Mix oxalic acid, citric acid, and milk, together; rub into the linen; repeat as it dries; wash, and bleach on the grass.

384. To Remove Common Ink Stains. Ink stains may be readily removed from white articles by means of a little salt of lemons, diluted muriatic acid, oxalic acid, or tartaric acid, and hot water; or by means of a little solution of chlorine or chloride of lime. When the stain is caused by ink manufactured with logwood, a red mark remains, which may be removed by the application of a little chloride of lime. All strong acids and alkalies tend to injure the fabric; therefore, immediately the stains are removed, the spots should be well rinsed, and repeatedly, in cold water.

385. To Remove Stains made by Hair Dye, or Indelible Ink. The staining principle of common indelible ink is nitrate of silver. It may be removed by first soaking in a solution of common salt, which produces chloride of silver, and afterwards washing with ammonia, which dissolves the chloride. Nitrate of silver, or hair dye stains can be removed by a solution of 10 grains of cyanide of potassium, and 5 grains of iodine to 1 ounce of water; or a solution of 8 parts of perchloride of mercury and muriate of ammonia in 125 parts of water. (*See Nos.* 129 *and* 387.)

386. To Remove Marking-Ink from Linen. Dip the garment in a solution of 1 ounce cyanide of potassium in 4 ounces of water. After a few hours the stain will be obliterated. This is very effectual, but the mixture is highly poisonous, and should be carefully removed.

387. To Remove Silver Stains from the Hands. Put ½ pound glauber salts, ¼ pound of the chloride of lime, and 8 ounces of water, into a little wide-mouthed bottle, and when required for use pour some of the thick sediment into a saucer, and rub it well over the hands with pumice stone or a nail-brush, and it will clean the fingers quite equal to cyanide, but without any danger. This will do to use over again until exhausted, and should be kept corked up. The disagreeable smell may be entirely avoided by the liberal use of lemon juice, which not only entirely removes the smell, but whitens the hands.

388. To Remove Stains from the Hands. Ink stains, dye stains, fruit stains, etc., can be immediately removed by dipping the fingers in warm water and then rubbing on the stain a small portion of oxalic acid powder and cream of tartar, mixed together in equal quantities, and kept in a box. When the stain disappears, wash the hands with fine soap. This mixture, being poisonous, must be kept out of the reach of children. A few drops of oil of vitriol (sulphuric acid) will also remove most stains from the hands without injuring them. Care must, however, be taken not to drop it upon the clothes. It will remove the color from woolen, and eat holes in cotton fabrics. The juice of ripe tomatoes will remove the stain of walnuts from the hands, without injury to the skin.

389. To take Ink Stains out of Mahogany. Put a few drops of spirits of nitre (nitric acid) in a tea-spoonful of water, touch the spot with a feather dipped in the mixture, and on the ink disappearing, rub it over immediately with a rag wetted in cold water, or there will be a white mark, which will not be easily effaced.

390. To take Ink Spots out of Mahogany. Apply spirits of salts (muriatic acid) with a rag until the spots disappear, and immediately afterward wash with clear water.

391. To Remove Ink from Mahogany. To ½ pint of soft water put 1 ounce of oxalic acid, and ½ ounce of butter (terchloride) of antimony; shake it well, and when dissolved it will be very useful in extracting stains from mahogany, as well as ink, if not of too long standing.

392. To Extract Ink from Floors. Remove ink from floors by scouring them with sand wet with water and the oil of vitriol, mixed. Then rinse them with strong saleratus water.

393. To Remove Stains on Mahogany Furniture. Stains and spots may be taken out of mahogany furniture by the use of a little aquafortis, or oxalic acid and water, by rubbing the part with the liquid, by means of a cork, till the color is restored; observing afterwards to well wash the wood with water and to dry and polish as usual.

394. To Extract Oil from Boards, Marble or other Stones. Make a strong lye of pearlashes and soft water, and add as much unslacked lime as it will take up; stir it together, and then let it settle a few minutes; bottle it and stop close; have ready some water to dilute it when used, and scour the part with it. If the liquor should lie long on the boards, it will draw the color out of them; therefore do it with care and expedition. When used for marble, the surface may be improved by rubbing or polishing afterward with fine putty-powder and olive oil. (*For Putty Powder, see Index.*)

395. To take Oil and Grease out of Boards. Make a paste with fuller's earth and hot water, cover the spots therewith, let it dry on, and the next day scour it off with soft or yellow soap.

396. To Clean Marble. To clean marble, mix quicklime with strong lye, so as to form a mixture having the consistency of cream, and apply it immediately with a brush. If this composition be allowed to remain for a day or two, and be then washed off with soap and water, the marble will appear as though it were new.

397. To Clean Marble. Take 2 parts of common soda, 1 part of pumice-stone, and 1 part of finely powdered chalk; sift it through a fine sieve, and mix it with water; then rub it well all over the marble, and the stains will be removed; then wash the marble over with soap and water, and it will be as clean as it was at first.

398. How to Clean Marble. The following is an excellent way of cleaning marble: First, brush the dust off the piece to be cleaned, then apply with a brush a good coat of gum arabic, about the consistency of thick office mucilage; expose it to the sun or dry wind, or both. In a short time it will crack and peel off. If all the gum should not peel off, wash it with clean water and a clean cloth. If the first application does not have the desired effect, it should be applied again.

399. To Clean Marble. Mix ¼ pound soft soap with the same of pounded whiting, 1 ounce soda, and a piece of stone-blue the size of a walnut; boil these together for ¼ of an hour; whilst hot, rub it over the marble with a piece of flannel, and leave it on for 24 hours; then wash it off with clean water, and polish the marble with a piece of coarse flannel, or, what is better, a piece of an old hat.

400. To take Stains out of White Marble. Take 1 ox-gall, 1 wine-glass soap lees, ½ wine-glassful turpentine; mix and make into a paste with pipe clay. Put on the paste over the stain and let it remain for several days. If the stain is not fully removed a second application will generally prove sufficient.

401. To Remove Oil Stains in Marble. Stains in marble caused by oil can be removed by applying common clay saturated with benzine. If the grease has remained long enough it will have become acidulated, and may injure the polish, but the stain will be removed.

402. To Remove Iron Mould or Ink from Marble. Iron mould and ink spots may be taken out in the following manner: Take ½ ounce butter of antimony and 1 ounce oxalic acid, and dissolve them in 1 pint rain water; add flour, and bring the composition to a proper consistence. Then lay it evenly on the stained part with a brush, and after it has remained for a few days wash it off, and repeat the process if the stain is not quite removed.

403. To Remove Stains from Marble. Mix an ox-gall with a quarter of a pound of soap-boiler's lye, and an eighth of a pound of oil of turpentine, and add enough pipe-clay earth to form a paste, which is then to be placed upon the marble for a time, and afterwards scraped off; the application to be repeated until the marble is perfectly clean. It is quite possible that a faint trace of the stains may be left; but this will be almost inappreciable. Should the spots be produced by oil, these are to be first treated with petroleum, for the purpose of softening the hardened oil, and the above-mentioned application may be made subsequently.

404. To Remove Printing Ink from any Article. Printing ink can be readily taken from any article by means of ether or oil of turpentine. Pure benzine will also have a similar effect.

405. To Remove the Varnish from Oil Paintings, &c. Varnish and dirt can be removed by washing over with a weak solution of carbonate of ammonia, wiping it off with a sponge wetted with water as soon as it has fulfilled its object; if allowed to remain too long it will injure the oil colors. Another way is to spread a thick coat of wet fuller's earth over the surface of the varnish, leaving it on long enough to soften it; it may then be removed by washing.

406. To Clean Pictures. Having taken the picture out of the frame, take a clean towel, and, making it quite wet, lay it on the face of the picture, sprinkling it from time to time with clean soft water; let it remain wet for 2 or 3 days; take the cloth off and renew it with a fresh one. After wiping the picture with a clean wet sponge, repeat the process till you find all the dirt is soaked out of it; then wash with a soft sponge, and let it get quite dry; rub it with some clear nut or linseed oil, and it will look as well as when freshly done.

407. To Clean Oil Paintings. Put into 2 quarts of strong lye, ½ pound of Genoa soap, rasped very fine, with 1 pint spirits of wine; let them simmer on the fire for half an hour, then strain them through a cloth. Apply the preparation with a brush to the picture, wipe it off with a sponge, and apply it a second time, which will remove all dirt. Then with a little nut-oil warmed, rub the picture and let it dry. This will make it look as bright as when it came out of the artist's hands. If the canvas is injured by damp, mildew or foul air, the first thing to be done is to stretch and line it with new canvas.

408. To Clean Japanned Waiters and Urns. Rub on with a sponge a little white soap and some lukewarm water, and wash the waiter or urn quite clean. Never use hot water, as it will cause the japan to scale off. Having wiped it dry, sprinkle a little flour over it; let it rest a while, and then rub it with a soft dry cloth, and finish with a silk handkerchief. If there are white heat marks on the waiters, they will be difficult to remove; but you may try rubbing them with a flannel dipped in sweet oil, and afterwards in spirits of wine. Waiters and other articles of *papier maché* should be washed with a sponge and cold water, without soap, dredged with flour while damp, and after a while wiped off, and then polished with a silk handkerchief.

409. Method of Cleaning Paper Hangings. Cut into 8 portions a loaf of bread 2 days old; it must neither be newer nor staler. With one of these pieces, after having blown off all the dust from the paper to be cleaned, by the means of a good pair of bellows, begin at the top of the room, holding the crust in the hand, and wiping lightly downward with the crumb, about half a yard at each stroke, till the upper part of the paper is completely cleaned all round. Then go round again, with the like sweeping stroke downwards, always commencing each successive course a little higher than the upper stroke had extended, till the bottom be finished. This operation, if carefully performed, will frequently make very old paper look almost equal to new. Great caution must be used not by any means to rub the paper hard, nor to attempt cleaning it the cross or horizontal way. The dirty part of the bread, too, must be continually cut away, and the pieces renewed as soon as may become necessary.

410. To take Grease Stains out of Wall Papers. Oil marks, and marks where people have rested their heads, can be taken from the paper on drawing-room walls by mixing pipe-clay with water to the consistency of cream, laying it on the spot, and letting it remain till the following day, when it may be easily removed with a penknife or brush.

411. To take Grease from Paper. Gently warm the parts containing the grease, and apply blotting-paper so as to extract as much as possible. Boil some clear essential oil of turpentine and apply it to the warm paper with a soft clean brush. A little rectified spirits of wine should be put over afterward.

412. To take out Stains of Ink from Books. Oxymuriatic acid removes, perfectly, stains of ink; and should the paper require bleaching, the operation will answer both ends at the same time. Nearly all the acids will remove spots of ink from paper; but it is important to use such as do not attack its texture. Spirits of salt (muriatic acid) diluted in 5 or 6 times the quantity of water, may be applied with success upon the spot, and after a minute or two, washing it off with clean water. A solution of oxalic acid, citric acid, and tartaric acid, is attended with the least risk, and may be applied upon the paper and plates without fear of damage. These acids taking out writing ink, and not touching the printing, can be used for restoring books where the margins have been written upon, without attacking the text.

413. To Remove Yellow Stains from the Margins of Engravings. The yellow stains on the margin of engravings may be removed by a solution of hydrochloride of soda. This liquid is commonly known under the name of Labarraque's solution.

414. To Clean Silver or Gold Lace. Lay the lace smooth on a woolen carpet or piece of woolen cloth, and brush it free from dust, then burn rock alum and powder it fine, and afterwards sift it through a lawn sieve; then rub it over the lace with a fine brush, and in so doing it will take off the tarnish and restore it to its brightness, if it be not too much worn on the threads.

415. To Clean Papier Maché. Papier maché articles should be washed with a sponge and cold water, without soap, dredged with flour while damp, and polished with a flannel.

416. To Clean Hair Brushes and Combs. Wash the bristles for a few seconds in a weak solution of hartshorn, say a tablespoonful to a pint of cold soft water. Then rinse in clean cold water, and dry. Do not set them near the fire, nor in the sun, to dry, but, after shaking them well, set them on the point of the handle in a shady place. By this process the brush will be thoroughly cleansed with very little trouble. Observe that the mahogany or satin-wood back of the brush must be kept out of the solution, as it is apt to discolor wood. Combs may be cleaned in the same manner.

417. To Clean Looking Glasses. Take part of a newspaper, fold it small, dip it in a basin of clean cold water, and when it is thoroughly wet squeeze it out as a sponge, and then rub it hard over the face of the glass, taking care that it is not so wet as to run down in streams. After the glass has been well rubbed with the wet paper, let it rest a few minutes and then go over it with a fresh dry newspaper, till it looks clear and bright, which it will do almost immediately. The inside of windows may be cleaned in this way, and they will look beautifully clear.

418. To Clean Straw Matting. Wash it with weak salt and water and dry it well, or boil a small bag of bran in 2 gallons of water, and wash the matting with the water, drying it well.

419. To Clean Cane-Bottom Chairs. Turn up the chair bottom, and with hot water and a sponge wash the canework well, so that it may become completely soaked. Should it be very dirty you must add soap. Let it dry in the open air if possible, or in a place where there is a thorough draught, and it will become as tight and firm as when new, provided it has not been broken.

420. To Clean Sheepskin Rugs or Mats. Make a very strong lather, by boiling soap in a little water; mix this with a sufficient quantity of water (rather more than lukewarm) to wash the mat or rug in, and rub boiled soap on those portions of it which require additional cleansing. When the mat has been well washed in this water, prepare another lather in the same way, in which a second washing must take place, followed by a third, which ought to be sufficient to cleanse it thoroughly. Rinse it well in cold water until all the soap is removed, and then put it in water in which a little blue has been mixed, sufficient to keep the wool of a good white, and prevent its inclining to yellow. After this it should be thoroughly wrung, shaken, and hung out in the open air with the skin part towards the sun, but not while it is scorching, otherwise the skin will become hard. It must also be shaken often while drying, for if not, it will be quite stiff and crackly. It should be frequently turned, being hung up first by one end and then by the other, until it has dried entirely.

421. To Clean Knives and Forks. Procure a smooth board, free from knots, or one covered with leather. If the latter, melt a sufficient quantity of mutton-suet, and put it hot upon the leather with a piece of flannel; then take two pieces of soft Bath brick, and rub them one against the other over the leather till it is covered with the powder, which rub in until no grease comes through when a knife is passed over the leather, which may easily be known by the knife keeping its polish. If only a plain board, rub the Bath brick 2 or 3 times over it; if too much be put on at once it will make the blades of the knives look rough and scratched. Let the board be of a proper height, and set so that the person may be a little on the stoop while cleaning the knives. Take a knife in each hand, holding them back to back; stand opposite the middle of the board; lay the knives flat upon it, and do not bear too hard upon them; by this method it will be easier to clean two knives at a time than one, and they will be less liable to be broken, for good knives will snap when pressed on too heavily. Many will say that they cannot clean two knives at once, or that they can get through them faster one by one; but if they will only try it a few times in the way recommended, they will find it not only much more expeditious, but easier. A little practice is all that is necessary.

The best way to clean steel forks is to fill a small barrel with fine gravel, brick dust, or sand, mixed with a little hay or moss; make it moderately damp, press it well down, and let it always be kept damp. By running the prongs of the steel forks a few times into this, all the stains on them will be removed. Then have a small stick, shaped like a knife, with leather round it, to polish between the prongs, having first carefully brushed the dust from them as soon as they are taken out of the tub. A knife-board is often spoiled in cleaning forks upon it, and likewise the backs of the knives; to prevent this, have a piece of old hat or leather put on the board where the forks and backs of the knives are cleaned.

422. To Preserve Knives and Forks in Good Condition. Wipe the knives and forks as soon as possible after being used, as the longer they are left with grease and stains on them the harder they will be to clean; particularly if they have been used for acids, salads, tarts, etc.; have then a jug of hot water ready to put them into as soon as done with, and wipe them as before directed.

In order to keep knives and forks in good condition when they are not in use, rub the steel part with a flannel dipped in oil; wipe the oil off after a few hours, as there is often water in it; or dust the blades and prongs with quicklime, finely powdered and kept in a muslin bag.

423. To Clean Spice Mills. It is often desired to grind different spices, orange or lemon peel, in the same mill, without any one being affected by another spice. Grind a teaspoonful of rice through the mill and all impurities will be removed. A coffee mill may be fitted to grind any spice in the same way, using rather more rice. The rice will of course be flavored by whatever may have been in the mill. It is useful to thicken soups, or gravies, or sauces, when the spice is no objection.

424. To Keep Oil-Cloths Looking Well. Wash them once a month in skim milk and water, equal quantities of each. Rub them once in three months with boiled linseed oil. Put on very little, rub it well in with a rag, and polish with a piece of old silk. Oil-cloths will last years if kept in this way.

425. To Clean Oil-Cloth. An oil-cloth should never be scrubbed with a brush, but, after being first swept, should be cleaned by washing with a soft flannel and lukewarm or cold water. On no account use soap, or water that is hot, as either would have a bad effect on the paint. When the oil-cloth is dry, rub it well with a small portion of a mixture of bees' wax, softened with a minute quantity of turpentine, using for this purpose a soft furniture polishing brush. Oil-cloth cared for in this way will last twice the time than with ordinary treatment.

426. To Give to Boards a Beautiful Appearance. After washing them very nicely with soda and warm water and a brush, wash them with a very large sponge and clean water. Both times observe to leave no spot untouched; and clean straight up and down, not crossing from board to board; then dry with clean cloths, rubbed hard up and down in the same way.

The floors should not be often wetted, but very thoroughly when done; and once a week dry-rubbed with hot sand and a heavy brush, the right way of the boards.

The sides of stairs or passages on which are carpets or floor-cloth, should be washed with sponge instead of linen or flannel, and the edges will not be soiled. Different sponges should be kept for the above two uses; and those and the brushes should be well washed when done with, and kept in dry places.

427. To Scour Boards. Lime, 1 part; sand, 3 parts; soft soap, two parts. Lay a little on the boards with a scrubbing-brush, and rub thoroughly. Rinse with clean water and rub dry. This will keep the boards of a good color, and will also keep away vermin.

428. To Clean Stone Stairs and Halls. Boil 1 pound of pipe-clay with a quart water, and a quart small beer, and put in a bit of stone-blue. Wash with this mixture, and, when dry, rub the stone with flannel and a brush.

429. To Clean Glass Globes. If the globes are much stained on the outside by smoke, soak them in tolerably hot water with a little washing soda dissolved in it; then put a tea-spoonful of powdered ammonia into a pan of lukewarm water, and with a tolerably hard brush wash the globes till the smoke stain disappears; rinse in clean cold water, and let them drain till dry; they will be quite as white and clear as new globes.

430. To Clean Decanters. There is often much difficulty experienced in cleaning decanters, especially after port wine has stood in them for some time. The best way is to wash them out with a little pearlash and warm water, adding a spoonful or two of fresh slaked lime if necessary. To facilitate the action of the fluid against the sides of the glass, a few small cinders may be used.

Or, soak the decanters for some hours in warm soda and water; if there is much cutting on the outside, a brush will be necessary to remove the dirt and stains from the crevices. Cut a potato into small dice, put a good handful of these into the decanter with some warm water, shake the decanter briskly until the stains disappear; rinse in clean cold water, and let them drain until dry. Vinegar and sauce cruets can be cleaned in the same way.

431. To Clean Glass Bottles. Chop up a large potato very fine and put it in the bottle with some warm water, and shake it rapidly until it is clean. Some use shot and soda, but potato is even more effectual.

432. To Clean Medicine Phials. Cleanse bottles that have had medicines in them, by putting ashes in each, immersing them in cold water, and then heating the water gradually till it boils. After boiling an hour, let them remain in the water till it is cold. Wash them in soap-suds, and rinse them till clean in clear water.

433. To Wash Castor Bottles. Put them ⅓ full of rice and fill up with warm water; shake them well; this will cleanse them thoroughly.

434. To Clean Greasy Earthenware. Stone pots and jars in which lard or fat has been kept, and yellow ware pie plates, may be cleaned by putting them in a kettle with ashes or sal soda, covering them with cold water, and allowing them to boil slowly an hour at least. When boiled enough, take them off the fire and leave them in the water until it cools.

435. To Clean Paint. There is a very simple method to clean paint that has become dirty, and if our housewives should adopt it, it would save them a great deal of trouble. Provide a plate with some of the best whiting to be had, and have ready some clean warm water and a piece of flannel, which dip into the water and squeeze nearly dry; then take as much whiting as will adhere to it, apply it to the painted surface, when a little rubbing will instantly remove any dirt or grease. After which wash the part well with clean water, rubbing it dry with a soft chamois. Paint thus cleaned looks as well as when first laid on, without any injury to the most delicate colors. It is far better than using soap, and does not require more than half the time and labor.

Another simple method is as follows:—put a table-spoonful of aqua ammonia in a quart of moderately hot water, dip in a flannel cloth, and with this merely wipe over the wood-work; no scrubbing will be necessary.

436. To Clean Varnished Paint. Boil a pound of bran in 1 gallon of water an hour, and wash the paint with the bran water.

437. To Clean Soiled Ribbons and Silks. A mixture of alcohol and *highly rectified* benzine is excellent for cleaning ribbons and silks. It is applied with a clean sponge. Persons who apply these liquids and mixtures to cleaning silks, &c., must be careful to do so in an apartment where there is neither fire nor lamp burning, under the penalty of an explosion. (*See No.* 346.)

438. To Remove Stains from Kid Gloves. Stains may be removed, even from the most delicately colored gloves, by suspending them for a day in an atmosphere of ammonia. Provide a tall glass cylinder, in the bottom of which place strong aqua ammonia. Be careful to remove from the sides of the jar any ammonia that may have been spattered upon them. Suspend the gloves to the stopper in the jar. They must not come in contact with the liquid.

439. To Clean Kid Gloves. Dr. Reimann gives the following directions, in the *Scientific American*, for cleaning kid gloves:—

A bottle 2 feet high, and 1 to 1½ feet wide, the stopper of which is also made of glass, is filled with 2 pounds of benzine. Then the gloves which are to be washed are put also into the bottle. On this account the neck of the bottle must be very wide, perhaps from ½ to ¾ foot in diameter. Such bottles are easily obtained, being much used in pharmacy. As many gloves may be introduced into the bottle as the liquid will cover. The bottle is then closed, well shaken, and allowed to stand some minutes. The shaking is repeated, the bottle opened, and the gloves taken out with a pair of iron forceps.

To prevent the possibility of there being any smell, it is a good plan to open the bottle under a good chimney, which thus carries off all the vapor that escapes.

The gloves, when brought by the forceps to the mouth of the bottle, are taken out, one after the other, by the hand, and wrung out, care being taken that the superfluous liquid runs back again into the bottle. It is highly advisable to perform this operation under a chimney, or the workman will soon suffer from the injurious influence of the volatile hydrocarbon.

Under the chimney is placed a cord stretched between two pins, and the gloves are hung upon this by means of small S-shaped hooks. After hanging a short time they will be dry.

The benzine contained in the bottle dissolves all the grease which adheres to the gloves, and the dirt which had been combined with the grease is consequently removed at the same time. The benzine remaining in the bottle assumes a dirty gray color during the process of washing.

When the benzine has become too dirty, it is put into a distilling apparatus, and distilled over. In this way the benzine is restored to its original purity and whiteness, so that it can be used again in further operations. (*For directions how to accomplish this, see next receipt.*)

The gloves, when taken out of the bottle, are often not quite clean, in which case it is necessary to rub them with a rag, moistened with benzine, in all places where they are still dirty.

Thus the last traces of dirt are removed, and the gloves become perfectly clean. In this state they may be hung on a cord under the chimney.

The gloves soon become dry, but a part of the benzine still remains behind, which is less volatile, and which, when the glove is in contact with the warm hand, causes a strong odor of benzine to be evolved.

To remove this also, the gloves are placed on a common plate, which is put upon an iron pot containing boiling water. The first plate is covered with a second, and the gloves between the two plates are heated at the boiling temperature of water, until the last traces of the unvolatilized benzine have escaped.

The gloves are now removed from the plate, and put upon a wooden glove-stretcher, or shape. In this way they are made to resume their original form, and are now ready for use.

The whole operation must be so conducted that no smell of benzine is perceptible. The smell of benzine is always a sign of carelessness on the part of the workman, who can readily conduct all the benzine vapors up the chimney. (*See No.* 346.)

440. To Re-Distill and Purify Benzine that has been used for Cleaning Kid Gloves. If the operation of distilling the benzine is disagreeable to the glove maker, he can have it purified at the apothecary's or chemist's. It is, however, an operation which he can readily perform himself

The apparatus is neither complicated nor expensive. A small wooden pail, such as is used in every establishment, is furnished with two holes. The first of these is drilled near the upper margin of the pail, so that, when the pail is filled with water, the water runs out through the hole, until the surface of the water within the pail is on a level with the lowest portion of the hole, that is to say, just below the upper margin of the vessel.

On the opposite side of the pail another hole is made, but this time near its bottom, so that water would run through this hole, until the surplus of the contained water was within a short distance of the bottom.

A leaden tube, the thickness of which equals the diameter of the hole, is bent so as to form a distilling worm, the upper end of which is inserted into the upper opening, and the lower end into the lower hole.

The tube is tightly inserted into both holes, so that no water can run through the space between the tube and the hole.

The pail is then filled with cold water.

The upper and lower ends of the leaden tube must project a little beyond the outer surface of the pail—perhaps two inches.

The lower end is bent downward a little. The upper end is a little enlarged, so that the tube forms a sort of funnel above.

In this is inserted a glass retort, conveniently fixed in a holder.

The space between the neck of the retort and the enlarged end of the leaden tube is conveniently filled with moistened cotton, so that no vapors can escape through it.

It is a good plan to employ a glass retort with a tube, so that any fluid can be poured into it when the apparatus is already fixed.

Having placed the retort on a vapor bath, where it can be heated at 212° Fahr., the neck of the retort is connected with the worm, as above mentioned, and the pail filled up with cold water. The retort is then filled with the impure benzine or petroleum essence which has been used in washing gloves.

After pouring in the benzine, the tube of the retort is closed by a stopper, and then the apparatus is completed by a bottle placed under the lower end of the leaden tube, which projects beyond the outer surface of the pail, so that the liquid running down this flows directly into the bottle.

The vapor bath is now heated, the retort soon becomes warm, and the volatile liquid begins to distill over, either quickly or slowly, according to the way in which the heating process is conducted.

The vapor of the hydrocarbon condenses in the worm, and a stream of liquid flows out of its mouth. In a short time there remains behind in the retort only the grease which the benzine has extracted from the gloves.

441. To Refine Ox-gall for Fixing Chalk and Pencil Drawings, and Removing Grease. Allow fresh ox-gall to repose for 12 or 15 hours, decant the clear, and evaporate to the consistence of a thick syrup, in a water-bath; then spread it *thinly* on a dish, and expose it before the fire, or to a current of dry air, until nearly dry. It will then keep for years in wide-mouthed bottles or pots, covered over with bladder. For *use*, a little is dissolved in water.

Or:—fresh gall, 1 pint; boil, skim, add pounded alum, 1 ounce; boil again until the alum is dissolved, and when sufficiently cool, pour it into a bottle, and loosely cork it down; in a similar manner boil and skim another pint of gall, and add to it 1 ounce of common salt; boil till dissolved, and cool and bottle as above. In three months decant the *clear* from both bottles, and mix them in equal quantities; the clear portion must then be separated from the coagulum by subsidence or filtration. It is employed by artists to fix chalk and pencil drawings before tinting them, and to remove the greasiness from ivory, tracing paper, &c. It is also used to extract grease and oil from clothes: for the latter purpose it answers admirably.

442. To Clean Cloth Clothes. Dissolve 4 ounces washing soda in 1 quart boiling water; when dissolved, add to it 1 moderate sized *fresh* beef's gall; lay the garment to be cleaned on a clean table or board, and with a sponge or brush (a brush is the best) wetted in the liquid, rub well the grease spots first, and afterwards the whole garment, frequently dipping the sponge or brush in the liquid; when sufficiently rubbed, rinse in cold water until the water is clear, then squeeze the water out thoroughly (but without twisting—if possible, use a patent wringer), shake well and hang in the air to dry. While drying, shake the garment occasionally and pull it into shape to prevent shrinking. When still slightly damp, press it on the wrong side with a warm iron, and then finish airing. Clothes cleaned in this way, if the directions be strictly followed, look almost equal to new. The use of the patent wringing machine is a great improvement in this operation, as it hastens drying, and prevents shrinking. The editor has used this receipt in his family for the last 15 years with the most satisfactory results. For dark-colored cloth garments, it is a common practice to add some fuller's earth to the mixture of soap and gall. When nearly dry, the nap should be laid right, and the garment carefully pressed, after which, a brush, moistened with a drop or two of olive oil, should be passed over it several times; this will give it a superior finish.

443. To Clean Woolen Clothes. Mix ½ ounce sulphuric ether and ½ ounce hartshorn (ammonia water) with 3 ounces water. Rub the article well with a sponge frequently wetted with the mixture, which will remove the dirt; then sponge with clean warm water; next lay a coarse towel, which has been saturated with hot water and wrung out, over the article, and press it with a hot iron; while the steam is still rising from the cloth, brush it down with a clothes brush.

444. To Clean Carpets. Carpets may be cleaned as follows: Take them up and shake and beat them, so as to render them perfectly free from dust. Have the floor thoroughly scoured and dry, and nail the carpet firmly down upon it. If still much soiled it may be cleaned in the following manner: Take a pailful of clean cold spring water, and put into it about 3 gills of ox-gall. Take another pail with clean cold water only. Now rub with a soft scrubbing brush some of the ox-gall water on the carpet, which will raise a lather. When a convenient sized portion is done, wash the lather off with a clean linen cloth dipped in the clean water. Let this water be changed frequently. When all the lather has disappeared, rub the part with a clean dry cloth. After all is done, open the window to allow the carpet to dry. A carpet treated in this way will be greatly refreshed in color, particularly the greens. Any particularly dirty spots should be rubbed by nearly pure gall first; and every spot of grease must be removed from the carpet by the following process: Scrape and pound together, in equal proportion, magnesia in the lump and fuller's earth. Having mixed these substances well together, pour on them a sufficient quantity of boiling water to make them into a paste. Lay this paste, as hot as possible, upon the grease spots upon the carpet, and let it dry. Next day, when the composition is quite dry, brush it off, and the grease spot will have disappeared. (*See No.* 357.)

445. To Clean Hearth Rugs and Stair Carpets. Hearth rugs and stair carpets may be treated in the same manner as given in the last receipt, only that these may be spread and washed upon a table.

446. How to Clean Carpets. Carpets may be washed on tables or on the floor. In either case they must be taken up and well beaten and swept. Grease is taken out by rubbing hard soap on the spot, and scrubbing it out with a brush dipped in clean cold water. Each spot must be rubbed dry with a cloth as it is washed. Dissolve a bar of soap in 2 gallons of water, by cutting it into the water and heating to a boil. Lay the carpet on the floor and tack it down, or have a heavy board, 3 feet wide by 12 feet long, laid on stout stands, or horses, and throw the carpet over that, keeping a clean board or sheet underneath to receive the carpet as it is cleansed. Provide brushes, and a quantity of coarse cotton cloths, flannels, and a large sponge. Take 2 pails filled with blood-warm water, put 2 quarts of the melted soap into one of them to scour the carpet with, and use the other for rinsing. Dip the brush in the soap-suds, and scour a square yard of the carpet at a time, using as little water as possible, not to soak it through. When the soap has done its work, rub it well out of the carpet with a flannel or coarse sponge, sucking up with these all the wet and dirt left by the brush, rinsing the article used in clean water repeatedly. Have ready a pail of clean cold water, with enough sulphuric acid or sharp vinegar in it to taste sour; dip a clean sponge in this, squeeze and rub it well into the spot just cleansed. Afterward wipe dry with coarse cloths, rinsing and hanging them where they will be dry when the next yard is washed. Finish yard after yard in this way, rubbing each clean and dry as you go. Keep a good fire in the room to dry the carpet thoroughly. If scoured on a frame, nail the carpet against the side of a house in the sun to dry. This is a tedious, but thorough process. Hearth rugs may be cleaned in the same way, beating and brushing them well, and tacking on a large board before washing. Scrub one-sixth of it at a time unless you are expeditious, and dry well with an old sheet. The secret of having carpets look well is to wash and rinse them thoroughly, without soaking them through. Ingrain, tapestry, Brussels, and Turkish carpets are all cleaned in this way. Good authorities recommend a tea-cupful of ox-gall to a pail of soap-suds, rinsing with clean water. (*See No.* 444.)

447. To Sweep Carpets. Before applying the broom, scatter over the carpet the refuse tea-leaves from the tea-pot. These should be set apart and saved in a pot kept for the purpose, squeezing the water out thoroughly in the hand. First rub the leaves into the carpet with the broom, and then sweep as usual. This will prevent dust and brighten the colors. Indian meal is recommended for this purpose by many experienced housekeepers.

448. To Clean Colored Silks, Moreens, Chintzes, and Printed Cottons. Colored or black silks, moreens, printed cottons, and chintzes, may be cleaned, without injury to their colors, by potato liquor. Grate raw potatoes to a fine pulp; add water in the proportion of 1 pint to 1 pound of potatoes; pass the liquid through a coarse sieve into a vessel, and allow it to remain till the fine white starch subsides to the bottom. Pour off the clear liquor, which is to be used for cleaning. Spread the article to be cleaned upon a table, which should be covered with a linen cloth; dip a sponge in the liquor, and apply it until the dirt is removed. Then rinse the article in clean cold water several times.

449. To Clean Old Tapestry on the Wall. Old tapestry is cleaned on the wall, beginning at the top. Melt a bar of good common soap in a gallon of water, and put 1 quart of it in a gallon of cold water. A clothes brush of fine broom straw or long bristles is best to dust with; a soft brush, piece of wash-leather, some flannels, and dry sheets are also needed. Brush all dust from the tapestry first, cleaning the corners well. Dip a flannel in the suds, squeeze it slightly, rub the tapestry to a lather, and brush well with a soft brush. Wring the flannel out of the soap, and rub the tapestry dry with it and wash-leather; lastly wiping the whole as dry as possible with a sheet, as it must not be rinsed. Melt 4 ounces of tartaric acid in a pint of boiling water, and add to it 2 gallons of clean water. Squeeze a clean sponge in this acid, and rub it well into the place just cleaned and dried; then finish with the dry sheet at once before going to the next yard of surface. Renew the suds and rinsing water frequently, as well as the towels, flannels, etc., for everything must be used clean. A good fire should be kept in the room when tapestry is cleaned. When dry, rub a lump of pipe-clay well into it, and brush it out with a good clothes brush. This takes the soap out and brightens the colors. Worsted work may be cleaned in this way.

450. To Clean Silk and Cotton, or Silk and Worsted Damask, Terry, or Brocatelle Curtains. Silk and cotton, or silk and worsted damask, terry, or brocatelle curtains, are cleaned over a board by scrubbing with $\frac{1}{2}$ a gallon camphene and a brush, first dipping the curtain into the camphene, then cleaning on the wrong side, and lastly on the right. Dip it again into the camphene just used, and rinse in the same amount of fresh camphene. Let it drain a minute, then wipe it off with a linen or cotton sheet till all the moisture possible is absorbed, and brush it with a dry brush of soft hair. Hang them in the air a few hours to take away the smell of camphene. 1 gallon is enough for each curtain width. Next roll the curtains in half-dry sheets to damp them; take them out; brush and rub them; then iron, with a damp cloth laid over them, and they will look like new.

451. To Clean Worsted Reps. Worsted rep sofas, and worsted furniture of any kind, are freshened by dusting damp Indian meal over them, and rubbing off with a stiff brush. Dry bran is said to answer the same purpose, or very light, dry snow, not suffered to melt on the surface. A large sheet should be spread under each piece of furniture, as it is cleaned, to catch the falling litter.

452. To Clean Table-Covers of Cotton and Worsted, Silk and Worsted, or Printed Cloth. Dissolve 1 bar of the best mottled soap in 4 gallons of scalding water, with 1 pound of pearlash in it. Have 3 tubs ready, and put in the first, 1 pail of cold water and 3 gallons of soap liquor; in the second, 1 pail of cold water and 2 gallons of soap liquor; and in the third, 2 pails of cold water and 1 gallon of soap liquor. In another tub have 6 pails of cold water, with a table-spoonful of oil of vitriol in it. If the cover is cotton and worsted, wash and wring it through the three soap-waters; rinse it five minutes in the vitriol tub, and wring out of cold, clear water; fold it up smoothly to drain, and hang it to dry without wringing.

For a silk and worsted cover use three soap-waters; rub it well, and, instead of the vitriol, put a pound of common salt in 2 pails of water, and work the cloth well in this. Rinse it in 2 cold waters after the salted one, and hang it to dry in a warm room.

A printed cloth wash through three soap-liquors; if one has a variety of table-cloths, of different mixtures, they may be put through the same suds in the order given in these directions, using different rinses for each. Give the printed cloth, after the last soap-liquor, two cold waters, with a table-spoonful of vitriol in each; after these, a cold, clear water. Fold and drain it, and dry quickly in a warm room, or the colors will run into one another. To press table-cloths, lay them under a damp sheet, and iron with a heavy iron.

453. To Clean White Jean Boots. If you have not boot-trees, stuff the boot as full as possible with common cotton wadding or old rags, to prevent any creases; then mix some pipe-clay with water to rather a stiff paste, wash the jean boots with soap and water and a nail brush, using as little water as possible to get the dirt off. When they look tolerably clean, rub the pipe-clay with a flannel well over them and hang them to dry. When dry, beat out the superfluous clay with the hand and rub them till they look smooth. Flake white may also be used.

454. To Clean White Kid Boots. If the kid boots are not very soiled they may be cleaned in the following manner: Put ½ ounce of hartshorn into a saucer, dip a bit of clean flannel in it and rub it on a piece of white curd soap; rub the boots with this, and as each piece of flannel becomes soiled, take a fresh piece; the boots will look like new.

455. To Clean White Satin Shoes. White satin shoes may be cleaned by rubbing them with stone blue and flannel, and afterwards cleaning them with bread.

456. To Clean Black, and Other Silks, with old Kid Gloves. Cut up a black kid glove in small pieces and pour a pint of boiling water over it. Cover it and let it stand all night where the water will keep warm if possible. In the morning let it boil up, strain it, and add 1 dessert-spoonful of alcohol. Keep it warm while sponging the silk on the *right* side and iron immediately on the *wrong* side. For light silks use white or light kid gloves. It will do without the alcohol, but is better with it.

457. To Clean Black Silks. Steep a few hours in cold water. Then put ¼ a pint of the *Black Reviver* in ½ a gallon of water, and a cupful of ox-gall. Make hot, and sponge the silk. Dry and smooth with an iron. (*See next receipt*).

Rusty black silk may be cleaned in the same way. Some persons clean black silk by rubbing it with a flannel dipped in gin.

458. Black Reviver, to Restore the Color of Black Silk, Cloth or Leather. Take of blue galls, bruised, 4 ounces; logwood, copperas, iron filings free from grease, and sumach leaves, each 1 ounce. Put all but the iron filings and copperas into 1 quart good vinegar, and set the vessel containing them in a warm water bath for twenty-four hours, then add the iron filings and copperas and shake occasionally for a week. It should be kept in a well-corked bottle. It may be applied to faded spots with a soft sponge. It is good also to restore the black color of leather when it turns red, the leather being previously well cleaned with soap and water.

459. To Restore Black Silk. To ox-gall, add boiling water sufficient to make it warm, and with a clean sponge rub the silk well on both sides; squeeze it well out, and proceed again in like manner. Rinse it in spring water, and change the water till perfectly clean; dry it in the air, then dip the sponge in glue-water, and rub it on the wrong side; pin it out on a table, and dry before a fire.

460. To Clean Silks, Satins, Colored Woolen Dresses, &c. 4 ounces of soft soap, 4 ounces of honey, the white of an egg, and a wine-glassful of gin; mix well together, and scour the article (which must be unpicked, and laid in widths on a kitchen table) with a rather hard brush, thoroughly; afterwards rinse it in cold water, leave to drain, and iron whilst quite damp, with a piece of thin muslin between it and the iron, or it will be marked on the ironed side. The silk, when laid on the table, must be kept quite smooth, so that every part may come under the brush. White silk requires a little blue in the water. This receipt is an excellent one.

461. To Raise the Nap on Cloth. Soak in cold water for ½ an hour, then put on a board, and rub the threadbare parts with a half-worn hatter's card, filled with flocks, or with a prickly thistle, until a nap is raised. Hang up to dry, and with a hard brush lay the nap the right way.

462. To Renovate Black Crape. Skim-milk and water, with a little bit of glue in it, made scalding hot, will restore old rusty black Italian crape. If clapped and pulled dry, like fine muslin, it will look as good as new.

463. To Raise the Pile on Velvet or Plush. Hold the wrong side of the velvet over the steam arising from boiling water, until the pile rises—or dampen lightly the wrong side of the velvet and hold it over a pretty hot iron, not hot enough to scorch, however: or, make a clean brick hot, place upon it a wet cloth, and hold the velvet over it, and the steam will raise the plush.

464. To Restore Creased Ribbons. Creased ribbons may be restored by laying them evenly on a board, and with a very clean sponge damping them evenly all over. Then roll them smoothly and tightly on a ribbon block, of greater breadth than the ribbon, and let them remain until dry. Afterwards transfer to a clean dry block. Then wrap in *brown* paper, and keep until wanted.

465. To Wash China Crape Scarfs. If the fabric be good, these articles of dress can be washed as frequently as may be required, and no diminution of their beauty will be discoverable, even when the various shades of green have been employed among other colors in the patterns. In cleaning them, make a strong lather of boiling water, suffer it to cool; when cold, or nearly so, wash the scarf quickly and thoroughly, dip it immediately in cold hard water in which a little salt has been thrown (to preserve the colors); rinse, squeeze, and hang it out to dry in the open air; pin it at its extreme edge to the line, so that it may not in any part be folded together. The more rapidly it dries the clearer it will be.

466. To Wash a Black Lace Veil. Mix bullock's gall with sufficient hot water to make it as warm as you can bear your hand in, and pass the veil through it. It must be squeezed, not rubbed; and it will be well to perfume the gall with a little musk. Rinse the veil through two cold waters, tinging the last with a little blue. After drying, put it into some stiffening made by pouring boiling water on a very small piece of glue; squeeze it out, stretch it, and clap it. Afterwards, pin it out on a linen cloth to dry, laying it very straight and even, and taking care to open and pin the edge very nicely. When dry, iron it on the wrong side, having laid a linen cloth over the ironing blanket.

Any article of black lace may be washed in this manner.

467. To Wash White Silk Stockings. Heat some rain or soft water, and while on the fire cut into it slices of good yellow soap, to make a lather; put the stockings in while the lather is warm, but not scalding, and wash them in two such waters (a wine-glassful of gin in the first water is an improvement); rinse them well in lukewarm water, having ready a second rinsing water, in which is mixed a little blue (not the common kind, but such as is used for muslins and laces), or rose pink, which can be procured at the chemist's, and is used in the same way as the blue, by tying it up in a piece of flannel and squeezing it into the water. After rinsing, put the stockings between towels and let them get almost dry; place them on a small sheet, lay them out quite flat, as they are when first purchased, tack them to the sheet with a needle and thread, turn the sheet over them, and have them mangled. If it is not convenient to have them mangled (run between weighted rollers), the next best plan is to put four or six stockings one upon the other between a piece of muslin, lay them on a stone doorstep, and beat them with the rolling pin. They must not be mangled or beaten in towels, as the pattern of the towels would be impressed on them. If the stockings have lace fronts they will more particularly require the tacking mentioned above to make them look nice. No soda or washing powder of any kind must be put to them, and they must be done quickly, and not left lying about.

468. To Clean Soiled Bed Ticks. Apply starch by rubbing it in thick with a wet cloth, then put the tick in the sun. When dry, rub it with the hands. If necessary, repeat the process, and the soiled part will be as clean as new.

469. To Restore the Gloss Finish on Woolen Goods, removed by Washing. Brush the cloth over, *the way of the cloth,* with a brush wetted with very weak gum-water; lay over it a sheet of paper or a piece of cloth, and put it under a weight or in a screw-press until dry. This will restore the original gloss to the dull spot often left after washing out a stain.

470. To Remove Stains from Black Crape and Mourning Dresses. Boil a handful of fig-leaves in 2 quarts of water, until reduced to a pint. Squeeze the leaves, strain the liquor, and put it into a bottle for use. Bombazines, crape, cloth, &c., should be rubbed with a sponge dipped in this liquor, and most stains will be instantly removed.

471. To Clean a White Lace Veil. Boil the veil gently for 15 minutes in a solution of white soap; put it into a basin holding warm water and soap, and keep gently squeezing it (do not rub it) till it is clean, and then rinse it from the soap. Then take a vessel of cold water, into which put a drop or two of chemic (*see No.* 162) or liquid blue; rinse the veil in it. Have ready some very clear gum arabic water, or some thin rice-water. Pass the veil through it. Then stretch it out even, and pin it to dry on a linen cloth, making the edge as straight as possible; opening out all the scallops, and fastening each with pins. When dry, lay a piece of thin muslin smoothly over it, and iron it on the wrong side.

472. To Wash White Silk Lace or Blond. Take a black bottle covered with clean linen or muslin, and wind the blond round it (securing the ends with a needle and thread), not leaving the edge outward, but covering it as you proceed. Set the bottle upright in a strong cold lather of white soap and very clear soft water, and place it in the sun, having gently with your hand rubbed the suds up and down on the lace. Keep it in the sun every day for a week, changing the lather daily, and always rubbing it slightly when you renew the suds. At the end of the week, take the blond off the bottle, and (without rinsing) pin it backward and forward on a large pillow covered with a clean tight case. Every scallop must have a separate pin; or more, if the scallops are not very small. The plain edge must be pinned down also, so as to make it straight and even. The pins should be of the smallest size. When quite dry, take it off, but do not starch, iron, or press it. Lay it in long loose folds, and put it away in a pasteboard box.

Thread lace may be washed in the same manner.

473. To Clean Thread Lace. Thread lace may be cleaned in the same manner as in last receipt. Or, when the thread lace has been tacked to the bottle, take some of the best sweet oil and saturate the lace thoroughly. Have ready in a wash-kettle, a strong cold lather of clear water and white Castile soap. Fill the bottle with cold water, to prevent its bursting, cork it well and stand it upright in the suds, with a string round the neck secured to the ears or handle of the kettle, to prevent its shifting about and breaking while over the fire. Let it boil in the suds for an hour or more, till the lace is clean and white all through. Drain off the suds and dry it on the bottle in the sun. When dry, remove the lace from the bottle and roll it round a white ribbon-block; or lay it in long folds, place it within a sheet of smooth white paper, and press it in a large book for a few days.

In washing laces, put 12 drops aqua ammonia in warm suds.

474. To Prepare Silks for Washing. Most colors are really improved by the following method, especially red, purple, orange, blue, olive, puce, &c. The more delicate greens are not improved, neither are they injured. This is likewise the case with lavender. If the silk is to be washed in a dress, the seams of the skirt do not require to be ripped apart, though it must be removed from the band at the waist, and the lining taken from the bottom. Trimmings, or furniture where there are deep folds, the bottom of which is very difficult to reach, should be undone so as to remain flat.

475. To Wash Silks. The article should be laid upon a clean smooth table. A flannel should be well soaped, being made just wet with lukewarm water, and the surface of the silk rubbed one way, being careful that this rubbing is quite even. When the dirt has disappeared, the soap must be washed off with a sponge, and plenty of cold water, of which the sponge must be made to imbibe as much as possible when the washing is done. As soon as one side is finished, the other must be washed precisely in the same manner. Let it be understood that not more of either surface must be done at a time than can be spread perfectly flat upon the table, and the hand can conveniently reach; likewise the soap must be quite sponged off one portion, before the soaped flannel is applied to another portion. The treatment of silks, after they have been thus washed, will be described hereafter. (*See next receipt.*)

Satin ribbons, both white and colored, and even satin dresses, may be cleansed with good effect by this process, which is likewise very effective in renovating all kinds of silk ribbons and trimmings.

476. To Stiffen Silk for Trimmings. Sponge the surface of the silk with a weak solution of gum arabic, or with equal parts of ale and water, and iron, while damp, on the wrong side. This is excellent when old silk is to be used for trimming, and it is necessary to keep it stiff.

477. To Wash Silk Pocket Handkerchiefs. Silk pocket handkerchiefs require to be washed by themselves, and those containing snuff should be put to soak in separate lukewarm water. Two or three hours after, they should be rinsed out and put to soak with the others in cold water for an hour or two. They should then be washed out in lukewarm water, being soaped as they are washed. If all the stains are not out of them, they must be washed through a second water of the same description. When finished, they should be rinsed in cold soft water, in which a handful of common salt has been dissolved. They may be rinsed all together, being thrown, as fast as they are washed, into a dry tub, whence, when all are done, they are transferred to the rinsing tub.

478. To Wash Point Lace. By following the directions laid down in this receipt, ladies may wash and finish their own point lace as thoroughly as any French laundress. Mix a tea-spoonful powdered borax in a basin of strong white Castile soap-suds. Baste the lace to be washed, very carefully, with *fine* cotton, upon two thicknesses of flannel. Soak the lace, thus arranged, in the soap-suds mixture for 24 hours, or longer if very dirty, changing the suds two or three times. Then let it lie for 2 or 3 hours in clean water to rinse, changing the water once. *Squeeze* it out (do not wring it), and, when partially dry, place the flannel with the lace on it, lace downwards, on two thicknesses of dry flannel laid on a table, and smooth it with a hot iron. During the whole process, the lace must remain basted on the flannel; and when it is pressed,. must lie sandwiched between the dry and damp flannel, and pressed upon the latter. When the lace is perfectly dry, rip it off.

479. Twelvetree's Washing Fluid for White Linen and Cotton Articles. Set aside the flannels and colored things, as they must not be washed in this way, then select from the clothes to be washed, all the coarse and dirtiest pieces from the fine; then put them in separate tubs of soft water to soak over night (the night previous to washing.) Then prepare in a separate vessel, the liquid for a large washing, namely, ½ pound of good brown soap, cut in small pieces; ½ pound soda, and 3 ounces fresh, unslacked lime, mixed in 1 gallon of boiling soft water. Stir well up, so as to mix the ingredients, and let it stand until morning. Then strain off the liquid, being careful to leave all sediment behind. Having ready about 10 gallons of boiling soft water in the boiler, pour in the prepared liquid (keeping out all settlings that may yet be remaining) then throw in your clothes and boil them twenty minutes or half an hour. Previous to which, put an earthen plate at the bottom of the boiler, to prevent the clothes from burning. After boiling the appointed time, take them out; scald them, blue them, and rinse them in clean soft water, warm or cold, and the clothes will be as clean and white as snow. By this method, the finest linens, laces, cambrics, etc., can be readily and easily cleansed with very little trouble.

Should there be only a small washing, and less than 10 gallons of water required to boil them in, less of the liquid of lime, soap, and soda, can be used in proportion. When there is any difficulty in procuring fresh lime, a quantity of the liquor may be made at once from the lime, which will keep for years, corked in bottles, and ready for use.

480. Bingham's Patent Wash Mixture. Take 5 pounds of bar soap, shave fine, add 1 quart of lye, ¼ ounce pearlash, dissolved over a slow fire. When dissolved, put into a vessel prepared for it to stand in; then add ½ pint turpentine, 1 gill hartshorn; stir well, and it is ready for use.

481. To Make Washing Fluid. To 1 gallon of common soft soap, (such as is made by the usual method of boiling the lye of wood ashes and fat together), take 4 ounces sal-soda, ½ gallon rain or soft water, and ½ gill spirits of turpentine; place them all in a pot over the fire, and allow the mixture to boil a few minutes; it is then ready for use, and can be kept in any earthen or stoneware vessel.

482. Washing Made Easy. The washerwomen of Holland and Belgium, so proverbially clean, and who get their linen so beautifully white, used refined borax as washing powder instead of soda, in the proportion of ½ a pound of borax powder to 10 gallons of water. They save soap nearly one half. All the large washing establishments adopt the same mode. For laces, cambrics, etc., an extra quantity of powder is used; and for crinolines (requiring to be made stiff) a stronger solution is necessary. Borax, being a neutral salt, does not in the slightest degree injure the texture of the linen. Its effect is to soften the hardest water, and therefore it should be kept on the toilet table.

483. White Lye for Washing. This is made by pouring a pailful of boiling water over 4 or 5 quarts of ashes. Let it stand a while to infuse; then pour in cold water to settle it, when you can pour it off clear. This is very good to boil dirty clothes in. When made nice, is equal to soda, and does not, unless made extremely strong, injure the clothes.

484. To Wash Linen in Salt Water. Drop into sea water a solution of soda or potash. It will become milky, in consequence of the decomposition of the earthy salts, and the precipitation of the earths. This addition renders it soft, and capable of washing. Its milkiness will have no injurious effect.

485. To Wash an Alpaca, Mousseline-de-Laine, or Lama Dress that has Bright or Delicate Colors. Boil 1 pound best rice in 1 gallon water for three hours. When boiled, pour off what will be sufficient to starch the dress; wash the dress well in the remainder, rice and all, using the rice for soap; rinse it in clean cold water, wring it well, then starch it with the rice water that was kept for that purpose, and hang it before the fire to dry. When dry enough, iron with a cool iron, as it is liable to scorch. If some parts of the dress get too dry, they must be damped with a wet cloth whilst ironing. No soap must be used. The best way is to boil the rice on the previous day, and merely warm it up the next morning, for then you have the day before you to complete the whole, as the dress must on no account lie damp, even for an hour, or the colors will be sure to run. This receipt will be found equally well suited to delicate painted muslins and piqués as to lama and alpaca dresses.

486. To Wash Colored Muslins. In washing colored muslins and linens, there are several very essential points to be observed, whereby the colors are preserved from injury. In the first place, they should not be soaped or soaked over night, as the more delicate of the hues would be deteriorated by such process. When ready for washing, they should, if not too dirty, be put into *cold* water and washed up very speedily; if very dirty, the water may be lukewarm and no more. But above all, be careful not to use the smallest particle of soda. The best soap for washing articles made of this material is the common yellow. It is much better than the mottled, because it is less harsh, and removes the dirt in a shorter period. A small piece of alum should be boiled in the water in which the lather is made. The soap should not be allowed to remain any time on the linen; the latter should be soaped and washed as rapidly as possible, and not lie in the water any length of time. One article should therefore be washed at a time, and immediately rinsed through two cold waters, the others remaining in a dry state by the side of the tub until they are taken to be washed each in its turn. The liquid in which the articles are to be rinsed in succession immediately as they are washed, should consist of 3 or 4 gallons of cold soft water, with a handful of table salt dissolved in it. Should alum not be added to the lather, then a tea-spoonful of vinegar should be stirred into the water for each rinsing; this will help to fix and brighten the colors. The moment an article is taken from the rinsing tub, it should be wrung very gently, being twisted as little as can be helped. After rinsing, they should be hung out immediately to dry.

487. To Preserve the Colors of Merino, Mousselines-de-Laine, Gingham, Chintz, and Printed Lawns. Before washing almost any colored fabrics, it is recommended to soak them for some time in water to every gallon of which is added a spoonful of ox-gall. A tea-cup of lye in a pail of water is said to improve the color of black goods, when it is necessary to wash them. A strong clean tea of common hay will preserve the color of French linens. Vinegar in the rinsing water, for pink or green, will brighten those colors, and soda answers the same end for both purple and blue.

The colors of the above fabrics may be preserved by using a strong milk-warm lather of white soap, and putting the dress into it, instead of rubbing it on the material, and stirring into a first and second tub of water a large table-spoonful of ox-gall. (*See No.* 489.)

488. Hints for Washing Colored Clothes. No colored articles should ever be boiled or scalded. Neither should they be allowed to freeze, or the colors will be irreparably injured. They should be ironed immediately they are dry enough, and not be allowed to lie damp over night, nor be sprinkled. They should not be smoothed with a *hot* iron. Pink and green colors, though they may withstand the washing, will frequently change as soon as a *hot* iron is put over them.

489. To Prepare Ox-gall for Washing Colored Articles. Empty the gall in a bottle, put in it a handful of salt, and keep it closely corked. A tea-cupful to 5 gallons of water will prevent colored articles from fading.

490. The French Method of Washing Colored Muslins, Piqués, &c. Prepare some rather warm (not hot) lather, made with soft water and the best white soap; wash the dresses one at a time, but do not soak them. As soon as the first lather looks soiled, squeeze the dress from it, and at once wash it again in a fresh lather. When thoroughly clean, rinse in pure cold water, lastly in water slightly blued; squeeze (not wring) the water completely from the dress, and hang it in a shaded place to dry; if wet weather, dry it by the fire. The best prints will fade if hung in the sunshine.

491. To Render the Colors of Cotton Fabrics Permanent. Dissolve 3 gills of salt in 4 quarts of water; put the calico in while hot, and leave it till cold, and in this way the colors are rendered permanent, and will not fade by subsequent washing.

492. To Wash Chintz, so as to Preserve its Gloss and Color. Take 2 pounds of rice and boil it in 2 gallons of water, till soft; when done, pour the whole into a tub; let it stand and cool till about the usual warmth for colored linens; put the chintz in, and use the rice instead of soap; wash it in this till the dirt appears to be out; then boil the same quantity as above, but strain the rice from the water, and mix it in warm water. Wash it in this till quite clean; afterwards rinse it in the water the rice was boiled in; this will answer the end of starch, and no dew will affect it, as it will be stiff while it is worn. If a dress, it must be taken to pieces, and when dried, hang it as smooth as possible; when dry, rub it with a smooth stone, but use no iron.

493. To Wash Flannels or other Woolen Articles. Have the suds ready prepared by boiling up some good white soap in soft water, but do not use the suds when boiling; let them be as hot as the hand will bear when the articles are put in. The flannels should not be rubbed with soap, nor should the material itself be rubbed, as in washing linen, &c., rubbing knots the fibres of the wool together; hence the thickening of the fabric and consequent shrinking in its dimensions. Sluice the articles up and down in plenty of suds, which afterwards squeeze (not wring) out. The patent clothes-wringers are a great improvement upon hand labor, as, without injury to the fabric, they squeeze out the water so thoroughly that the article dries in considerably less time than it would do even after the most thorough hand wringing. After rinsing, squeeze out the water, and dry in the open air, if the weather is such as to admit of the articles drying quickly; if not, dry in a warm room, but avoid too close proximity to a fire. Let any dust or mud be beaten out or brushed off prior to washing.

All flannels should be soaked before they are made up, first in cold and then in hot water, in order to shrink them.

494. **To Shrink Flannel.** Flannel should be soaked in cold hard water before making, and hung up to drain and dry without any squeezing or handling in the water. After this it will not shrink in washing. Fill a tub with spring water, place the flannel in it, and take out as soon as it sinks to the bottom. It does not lose the appearance of new flannel when dry.

495. **To Wash Red Flannel.** To wash red or scarlet flannel when soiled, mix a handful of flour in a quart of cold water, and boil ten minutes. Add this to some warm suds, and wash the flannel gently; rinsing rather than rubbing it (*see No.* 493), rinse it in three or four warm waters, and the brightest scarlet will never lose its color. Soft soap or olive soap should be used for woolen goods in preference to bar soap.

496. **Scotch Method of Washing Woolen Shawls.** Scrape 1 pound soap, boil it down in sufficient water. When cooling, beat it with the hand; it will be a sort of jelly. Add 3 table-spoonfuls spirit of turpentine, and 1 of spirit of hartshorn. Wash the articles well in it, then rinse in cold water until all the soap is taken off, then in salt and water. Fold between two sheets, taking care not to allow two folds of the article washed to lie together. Iron with a very cool iron. Shawls done in this way look like new. Only use the salt where there are delicate colors that may run.

497. **To Make Starch for Linen, Cotton, &c.** To 1 ounce of the best starch add just enough soft cold water to make it (by rubbing and stirring) into a thick paste, carefully breaking all the lumps and particles. When rubbed perfectly smooth, add nearly or quite a pint of boiling water (with bluing to suit the taste), and boil for at *least half an hour*, taking care to stir it well all the time, to prevent its burning. When not stirring, keep it covered, so as to protect it from dust, etc. Also keep it covered when removed from the fire, to prevent a scum from rising upon it. To give the linen a fine, smooth, glossy appearance, and prevent the iron from sticking, add a little spermaceti (a piece as large as a nutmeg) to the starch, when boiling, and ½ a tea-spoonful of the finest table-salt. If you have no spermaceti, take a piece of the purest, whitest hog's lard, or tallow (mutton is the best), about as large as a nutmeg, or twice this quantity of the best refined loaf sugar, and boil with the starch. In ironing linen collars, shirt bosoms, etc., their appearance will be much improved by rubbing them, before ironing, with a clean white towel, dampened in soft water. The bosom of a shirt should be the last part ironed, as this will prevent its being soiled. All starch should be strained before using.

498. **Gum Arabic Starch for Making Shirt-Bosoms Glossy.** Procure 2 ounces of fine white gum arabic, and pound it to powder. Next put it into a pitcher, and pour on it a pint or more of boiling water, according to the degree of strength you desire, and then, having covered it, let it set all night. In the morning, pour it carefully from the dregs into a clean bottle, cork it, and keep it for use. A table-spoonful of gum water stirred into a pint of starch that has been made in the usual manner, will give a beautiful gloss to shirt-bosoms, and to lawns (either white or printed) a look of newness to which nothing else can restore them after washing. It is also good (much diluted) for thin white muslin and bobbinet.

499. **To Make Starch for Colored Articles.** For starching muslins, ginghams, and calicoes, dissolve and add to every pint of starch, a piece of alum the size of a shell-bark. By so doing, the colors will keep bright for a long time, which is very desirable when dresses must be often washed, and the cost is but a trifle.

500. **To Starch Muslins and Piqués.** In getting up muslins and piqués, the failure is not generally in the washing, but in the starching. A good-sized panful of starch should be used, in which 3 or 4 inches of spermaceti candle has been melted whilst hot. The articles should be thoroughly squeezed from the starch, and folded whilst wet, between folds of old sheeting or table linen. They should then be passed through a wringing machine. All lumps of starch are thus removed.

Piqués should be ironed as lightly as possible, and the iron ought never to come into contact with the outside surface of the piqué. An old cambric handkerchief is the best thing to use under the iron where absolutely necessary to iron on the right side.

501. **To Clear-starch Lace, Cambric and Book Muslin.** Starch for laces should be thicker and used hotter than for linens. After the laces have been well washed and dried, dip them into the thick hot starch in such a way as to have every part properly starched. Then wring all the starch out of them, spread them out smooth on a piece of linen, roll them up together, and let them remain for about half an hour, when they will be dry enough to iron. Laces should never be clapped between the hands, as it injures them. Cambrics do not require so thick starch as net or lace. Some people prefer cold or raw starch for book-muslin, as some of this kind of muslin has a thick, clammy appearance if starched in boiled starch. Fine laces are sometimes wound round a glass bottle to dry, which prevents them from shrinking.

502. **To Fold Clothes after Drying on the Line.** Fold the fine articles and roll them in a towel, and then fold the rest, turning them all the right side outward. Lay the colored articles separate from the rest. They should not remain damp long, as the colors might be injured, and starched fabrics are apt to mildew. Sheets and table linen should be shaken and folded.

503. To Iron Clothes. In ironing a shirt, first do the back, then the sleeves, then the collar and bosom, and then the front. Iron calicoes generally on the right side, as they thus keep clean for a longer time. In ironing a frock, first do the waist, then the sleeves, then the skirt. Keep the skirt rolled while ironing the other parts, and set a chair to hold the sleeves while ironing the skirt, unless a skirt-board be used. Silk should be ironed on the wrong side, when quite damp, with an iron which is not very hot, as light colors are apt to change and fade. In ironing velvet, turn up the face of the iron, and after dampening the wrong side of the velvet, draw it over the face of the iron, holding it straight; always iron lace and needlework on the wrong side, and put them away as soon as they are dry.

504. To Restore Scorched Linen. It is almost needless to premise that if the tissue of linen is so much burnt that no strength is left, it is useless to apply the following composition; for nothing could prevent a hole from being formed, although the composition by no means tends to injure the fabric. But if the scorching is not quite through, and the threads not actually consumed, then the application of this composition, followed by two or three good washings, will restore the linen to its original color; the marks of the scorching will be so totally effaced as to be imperceptible, and the place will seem as white and perfect as any other part of the linen. Mix well together 2 ounces fuller's earth reduced to a powder; 1 ounce hen's dung; ½ ounce of cake soap, scraped; and the juice of 2 large onions, obtained by the onions being cut up, beaten in a mortar, and pressed. Boil this mass in ½ pint strong vinegar, stirring it from time to time, until it forms a thick liquid compound. Spread this composition thickly over the entire surface of the scorched part, and let it remain on 24 hours. If the scorching was light, this will prove sufficient, with the assistance of two subsequent washings, to take out the stain. If, however, the scorching was strong, a second coating of the composition should be put on after removing the first; and this should also remain on for 24 hours. If, after the linen has been washed twice or thrice, the stain has not wholly dissappeared, the composition may be used again, in proportion to the intensity of the discoloration remaining, when a complete cure will seldom fail to be effected. It has scarcely ever happened that a third application was found necessary. The remainder of the composition should be kept for use in a gallipot tied over with bladder.

505. To Remove the Stain of Perspiration. For removing the stain of perspiration a strong solution of soda is first to be applied, with a subsequent rinsing with water.

506. To Bleach Yellow Linen. Linen that has acquired a yellow or bad color by careless washing, may be restored to its former whiteness by working it well in water containing a clear solution of chloride of lime, rinsing it well in clean water, both before and after using the bleaching liquor. Never attempt to bleach unwashed linen, and avoid using the liquor too strong, as in that case the linen will be rendered rotten.

507. To Bleach Yellow Flannel. Flannel which has become yellow with use may be whitened by putting it for some time in a solution of hard soap, to which strong ammonia has been added. The proportions are 1½ pounds hard curd soap, 50 pounds of salt water and ⅔ pound strong ammonia. The same object may be attained in a shorter time by placing the garments for a quarter of an hour in a weak solution of bisulphite of soda to which a little hydrochloric acid has been added.

508. How to Whiten Flannel and Woolen Hose. Wet the flannel yarn or hose (whatever you wish to whiten) in weak suds; wring out. Then hang on sticks or cords across a barrel with 2 table-spoonfuls of pulverized brimstone or sulphur burning under it; cover the barrel tightly. If they are not white enough, repeat the process; hang in the open air a day, then wash and rinse in bluing water. Be careful not to have the sulphur blaze and scorch the garments.

509. To Bleach Brown Sheeting. Having soaked the cloth 12 hours in strong soap-suds, take ¼ pound chloride of lime for every 12 yards of sheeting, and dissolve it in enough boiling water to cover the cloth when dipped into it. As soon as the lime is dissolved, strain the solution through a flannel or other coarse cloth, then put the brown sheeting in the strained lime-water, stirring constantly, and after it has remained thus in this liquor for about half an hour, take out the cloth and rinse it well in pure water, so as to be sure to remove all the lime-water; and then boil it up in strong soap-suds, and hang out to dry, and the work of weeks will have been accomplished in a day or two.

510. Bleaching by Oil of Turpentine. A German authority recommends the use of oil of turpentine in bleaching white goods. Dissolve 1 part oil of turpentine in 3 parts strong alcohol, place a table-spoonful of the mixture in the water used for the last rinsing. The clothes are to be immersed in this, well wrung out, and placed in the open air to dry. The bleaching action of the oil consists in its changing oxygen into ozone when exposed to the light, and in this process the turpentine disappears, leaving no trace behind.

511. To Clean Straw Bonnets. First brush them with soap and water; then with a solution of oxalic acid.

512. To Clean Door-Plates. To clean silver door-plates, use a weak solution of ammonia in water, applied with a wet rag. This wash is equally useful for silver plate and jewelry.

513. To Clean Plated-Ware. Make a paste with whiting and alcohol, apply it to the plated articles, and after it is dry, rub it off with a brush (if rough), or a soft rag, if smooth.

514. To Remove Rust Spots from Marble. Rust spots can be made to disappear by treatment with a weak solution composed of 1 part nitric acid and 25 of water, and afterward rinsing with water and ammonia.

515. To Remove Ink Spots from Marble. Ink spots may be removed by first washing with pure water, and then with a weak solution of oxalic acid. Subsequent polishing, however, will be necessary, as the lustre of the stone may become dimmed. This can be best secured by very finely powdered soft white marble, applied with a linen cloth first dipped in water and then into the powder. If the place be subsequently rubbed with a dry cloth the lustre will be restored.

516. To Remove Copper Spots from Marble. Copper spots may be removed by diluted sulphuric acid and ammonia, and subsequently with water and ammonia.

517. To Remove Match Stains from Marble. Spots from sulphur and phosphorus, caused by lucifer-matches, can be extracted from marble by sulphide of carbon.

The Art of Soap-Making.

Soap is a chemical combination of a fatty substance with caustic lye, the base of which is either potash or soda; the former producing soft, and the latter, hard soaps.

519. To Make Soap-makers' Lye. To 1 part of quicklime, slacked by sprinkling on it sufficient water to crumble it, add a solution of 3 parts soda in 5 parts water. For soft-soap lye, an equal quantity of potash is substituted for the soda. Stir the mixture and allow it to settle; the clear liquid is then poured off, and constitutes the *first lye,* and is of a strength of 25° to 30° Baumé; the *second, third* and *fourth* lye is each obtained by adding successively 5 parts water, stirring thoroughly, allowing it to settle, and pouring off the clear liquid; producing respectively a lye of from 12° to 18°, 8° to 10°, and 2° to 5° Baumé.

520. To Make Soap. Having thus prepared the lye, the first, second and third lyes being sufficient for general purposes, take 20 pounds of pure grease, and melt it slowly in an iron vessel; keep it at a moderate heat, and stir in, a little at a time, 10 pounds *third lye;* after stirring for about an hour, let the mixture get up to a boiling heat, and then stir in, by degrees, 10 pounds *second lye;* this will complete the first stage of the process, which is termed *saponification.* The next step, called cutting up the pan, is to add, by degrees, a mixture of soda and lye with from 2 to 3 pounds common salt; this separates the excess of water from the curd, leaving a soapy paste; boil and stir for some time, then let it settle, and draw off the water. The third operation, clear boiling, has now to be performed; stir into the paste, by degrees, 5 pounds *first lye;* and, when perfectly mixed and smooth, boil the whole for two hours; should the soap, during the intervals, become too liquid, which may happen when too weak a lye has been used, some salt, or a weak lye containing salt, must be added. The boiling is terminated when large, regular, dry scales appear on the surface; when this is the case let it settle, and draw off the fluid which remains. Put the soap into frames lined with cotton cloth which has been well powdered with a mixture of lime and starch, and as soon as the soap has become firm, lay it out to dry.

521. Hard and Soft Soap. Soaps are thus of two kinds, hard and soft, this condition being influenced both by the fat and alkali employed. The firmer and harder the fat, the solider will be the resulting soap. With the same alkali, therefore, tallow will make a harder soap than palm or olive oil, and stearic acid than oleic acid. But the consistence of soaps depends far more upon the alkali employed. Potash is very deliquescent, that is, has a strong attraction for water, so that when exposed it will absorb it from the air and run down into a fluid or semi-fluid state. The potash retains this water in the condition of soap, so that potash soaps are always liquid and soft. The hard soaps, therefore, all contain soda, those with tallow or stearic acid being the hardest. Potash soaps will not dry, but retain their soft, jelly-like condition, while some kinds of soda soap become so hard by drying that at last they can be pulverized. The admixture of a very small quantity of sulphate of soda hardens soap and also checks waste from too rapid solubility in hot water. When soda and potash alkalies are used in combination, a proportion of from 10 to 20 per cent. of the latter is employed, according to the degree of hardness the soap is desired to possess.

522. Common Yellow Soap. Common yellow hard soap consists of soda, with oil or fat and resin. Resin is a feeble acid, capable of combining with alkali, but neutralizing it less completely than oil, so that the compound or soap formed is too powerfully alkaline. But when resin is worked with an equal or larger proportion of oil, it makes an excellent soap for many purposes.

523. Beef Tallow. This fat, on account of its abundant supply, is the most used by soap and candle makers. It is not as white as many other animal fats, and the best quality, the North American, contains about 70 per cent. of stearine. It does not melt below 111° Fahr., but may afterwards be cooled down to 102° without solidifying, and when cold, is firm, and even brittle.

524. Mutton Suet. This is generally firm, white, and very rich in stearine; this latter quality gives it a tendency to produce a soap of too hard and brittle a nature for general use, which is obviated by mixing about one-fifth or one-sixth part of lard, or some other more oleaginous fat; thus modified it is specially adapted for stock for toilet soaps.

525. Lard. The best quality of lard melts at 81° Fahr., and contains about 60 per cent. of oily fat, known as lard oil, and about 30 per cent. solid stearine. It makes a pure, white soap, and is frequently combined with tallow or other saponaceous fat.

526. Bone Fat, obtained by boiling fresh bones, split open lengthways, is very well adapted for making soaps, but generally undergoes a process of purification before being thus employed. (*See No.* 534.)

527. Cocoanut Oil possesses two prominent qualities which specially recommend it as an ingredient in soap-making. It imparts a great degree of firmness to the soap, probably owing to the solid form of the fatty acids found in it. It will also unite permanently with soda lyes in any proportion; and, in combination with other fat substances, imparts whiteness and emollient properties to them; it also froths as well in cold as in hot water, which is not the case with tallow soaps worked with soda.

528. Palm Oil. This substance is used in the manufacture of soap. Its genuine quality is easily tested by its solubility in acetic ether, the imitations sometimes sold under the same name being insoluble in it. It is used in its natural state, but its distinctive qualities and white color are greatly increased by bleaching. (*See No.* 537.)

529. To Clarify Fat Used in Making Fine or Toilet Soaps. Heat the fat in a clean iron or copper kettle, applying just heat enough to melt it thoroughly; then filter it through fine linen or muslin.

530. To Deodorize Fat for Making Perfumed Soap. Boil for 10 minutes 100 pounds of the fat with about 35 pounds water containing 6 ounces common salt and 3 ounces powdered alum; strain the water off, and let the fat rest for some hours before using.

531. To Prevent Fatty Substances from Turning Rancid. Boil for about 10 minutes with the salt and alum solution, as in last receipt; strain the water off, and then gently simmer the clarified fat with 4 ounces benzoin and 1 gallon rose water; skim off and let it cool. Fat thus treated will keep for years.

532. To Grain or Granulate Tallow. Melt the tallow and stir it with twice its quantity of water at a blood heat until it is cold; strain the fat from the water, and dry by exposing it to a current of dry air. Tallow in this granulated form combines more readily with lye for soap-making purposes. (*See No.* 535.)

533. To Purify Tallow and Other Fats. Tallow and other fats are commonly purified by melting them along with water, passing the mixed fluids through a sieve, and letting the whole cool slowly, when a cake of cleansed fat is obtained. Another plan is to keep the tallow melted for some time, along with about 2 per cent. of oil of vitriol largely diluted with water, employing constant agitation, and allowing the whole to cool slowly; then to re-melt the cake with a large quantity of hot water, and to wash it well. Another method is to blow steam for some time through the melted fat. By either this or the preceding process a white hard tallow may be obtained. Some persons add a little nitre to the melted fat, and afterwards a little dilute nitric or sulphuric acid, or a solution of bisulphate of potash. Others boil the fat along with water and a little dilute nitric or chromic acid, and afterwards wash it well with water.

534. To Purify Bone Fat. Melt the fat with a small quantity of saltpetre (nitrate of potassa); then add sufficient sulphuric acid to decompose the saltpetre. The mass, after the scum is removed, becomes a light yellow color, and is completely deprived of all offensive smell and animal impurities.

535. To Keep Tallow from Turning Rancid. Cut 50 pounds tallow into slices, and boil it in about 2½ gallons water containing 2 ounces alum and 4 ounces salt; strain the fat from the liquid, and wash it in clean water; put into a clean barrel twice as much water at a blood heat as there is grease, and dissolve in the water about 1 part of clean soap to 10 parts of the grease; next warm the grease to a blood heat and pour it into the barrel of water, stirring it together until cold; let it rest until the fat has risen to the surface, when the water must be drawn away through a hole in the bottom of the barrel, hitherto tightly corked. The fat in a granulated state must be thoroughly dried by exposure to a current of dry air; and, when perfectly dry, packed in barrels or other vessels. The *graining* of the fat at the same time greatly facilitates its combination with lye for the purposes of soap-making.

536. To Preserve Grease. Boil all the scraps, rinds, and bones, in a weak lye, and the purer grease in clear water. Let the mixture cool, take off the cake of grease, and strain it. It is well to do this occasionally, as you save it; for when kept a long time impure grease becomes offensive. You must be careful to dry off all the water before laying it away in the grease tub, if you wish it to keep sweet. The best plan to collect dripping is to put it while warm into water nearly cold. Any impurities it may contain will sink to the bottom.

537. To Bleach Palm Oil. Dissolve ½ pound powdered red chromate of potassa in about a quart hot water. 100 pounds palm oil are heated in a wooden tank, by steam, to a temperature of 120° Fahr. The steam is then turned off and a portion of the chrome solution is stirred in, followed by a proportional quantity of 1 pound strong muriatic acid. After the whole of the solution and of the acid has been thoroughly mixed with the palm oil, stir in ½ pound sulphuric acid. The oil becomes black, then dark green, and finally light green, with a thick froth on the surface. If, when the mixture has settled, the oil is not sufficiently bleached, the operation has to be repeated, using less proportion of chrome and acids. When the bleaching is complete, the oil is allowed to stand for an hour to clear; it is then run into a wooden tank with some water, and heated again, to wash out any salts that may remain in it, and after a time drawn off ready for use. Palm oil is usually combined with from 3 to 5 times its weight of tallow to make soap, and is serviceable in resin soap to brighten its color and disguise the resin.

538. Filled Soap. Hard soaps are usually made according to the process before described (*see No.* 520), the excess of water being separated from the paste by the use of salt: this class of soap is termed *grained soap.* But there are some kinds—cocoanut oil and soda soap, for instance—that are so hard in their nature that the operation of salting, or *graining,* is needless, the water remaining incorporated in the paste; soaps of this class are called *filled soaps.*

539. To Make Tallow Soap. The French Method. Melt in a boiler, by a moderate heat, 500 pounds tallow; stir in, by degrees, 35 to 40 gallons caustic soda lye of 10° to 12° Baumé, and let it boil gently for several hours; then add, gradually, 18 to 20 gallons caustic soda lye of 15° to 18° Baumé, and mix until the whole becomes a homogeneous mass of a grayish color; keep the mixture boiling gently for some hours, adding to it every hour 3 to 4 gallons caustic soda lye of 20° Baumé. This will occupy 10 or 12 hours. The salting process then follows, and is conducted as described in No. 520. After the separation or graining is finished the paste is allowed to stand for a few hours, and the lye is drawn off through a faucet inserted for the purpose in the side of the boiler, near the bottom. The mass is again boiled for some hours, adding every hour 2½ gallons soda lye of 25° Baumé, until the hard scales rise to the surface. (*See No.* 520.) The fire should then be extinguished, and after an hour the under-lye is to be drawn off. Then boil again for 1½ to 2 hours with about 25 gallons soda lye of 4° Baumé, stirring from time to time. The fire should then be removed, and the pan covered up; the soap will rise to the top of the lye, and may be poured into the frames, care being taken that no lye gets mixed with the soap. This should yield about 850 pounds of soap.

540. Tallow Resin Soap. About 15 per cent. of resin can be mixed with tallow without injuring the color and firmness of the soap. A larger proportion deteriorates the quality and produces an inferior soap. Some soap-makers melt the resin and tallow together before saponifying; but it is better to make a soap of each in separate boilers, and then mix and boil them together thoroughly for half an hour, and strain through a sieve before filling the frames.

541. To Make Resin Soap. Boil 12 gallons caustic soda lye of 30° Baumé in a kettle, and add 100 pounds well pulverized resin, 10 or 15 pounds at a time, stirring constantly and thoroughly, the heat being kept up to or nearly at boiling point. Saponification will be effected in about 2 hours. The lightest resin is the best for soap.

542. Cocoanut Oil Soap. Put 100 pounds cocoanut oil and 100 pounds caustic soda lye of 27° Baumé into a soap kettle; boil and mix thoroughly for 1 or 2 hours, until the paste gradually thickens; then diminish the heat, but continue stirring till the cooling paste assumes a white, half-solid mass; then transfer quickly to the frames. A mixture of equal parts of cocoanut oil and tallow will make a very fine *filled* soap. (*See No.* 538.) Cocoanut oil mixed with almost any fats, if they are not in too large proportions, will produce filled soaps.

543. Palm Oil Soap. Palm oil is seldom used alone as a saponaceous fat, but is employed in conjunction with other fats, and with resin; this latter being usually saponified separately and mixed afterwards. (*See No.* 540.) The directions for making tallow soap apply equally well to palm oil. The following are among the best mixtures and proportions of palm oil for soaps:

30 pounds palm oil, 20 pounds tallow, and 2 pounds resin.

30 pounds palm oil, 50 pounds tallow, and 20 pounds resin.

90 pounds palm oil and 10 pounds cocoanut oil.

15 pounds palm oil, 55 pounds lard, 5 pounds cocoanut oil, and 5 pounds clarified resin.

544. To Make Soap from Grained Tallow. Mix 6 pounds caustic soda and 2 pounds caustic potash with 17 to 20 gallons hot water; put a portion of this lye into a clean barrel; stir in by degrees 25 pounds grained tallow; add the rest of the lye and stir it briskly for at least an hour; then let it rest, and before it is cold pour it into a frame or box, and finish according to No. 520.

545. Dawson's Patent Composite Soap. Strong potash lye, 75 pounds; tallow, 75 pounds; cocoanut oil, 25 pounds. Boil until the compound is saponified in the usual manner.

To make 30 pounds of the new composition, take 2 gallons boiling soft water in a kettle, add ½ pound sal soda, 2 ounces borax, 2 table-spoonfuls spirits of turpentine, and 1 tea-spoonful linseed oil. Stir this mixture until the borax and soda are dissolved; then add 15 pounds of the above soap made from lye, tallow, and cocoanut oil; and continue the boiling with stirring for 15 minutes, until the whole is incorporated and dissolved. Now add 2 ounces spirits of hartshorn, and stir. It may be scented with any essential oil, or odor, and colored, if desired; then run off and molded into cakes fit for toilet use. It is a good soap for chapped hands, and is free from any disagreeable odor.

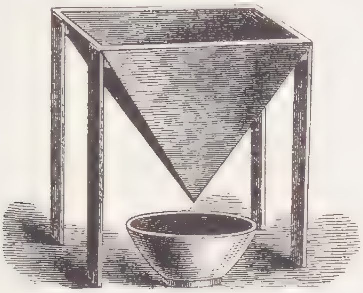
546. Chemical Soap. Powdered fuller's earth, 1 ounce; just moisten with spirits of turpentine; add salt of tartar, 1 ounce; best potash, 1 ounce; work the whole into a paste with a little soap. It is excellent for removing grease spots.

547. To Make Hard White Tallow Soap. Dissolve 2 pounds sal soda in 1 gallon boiling soft water; mix into it 2 pounds fresh slacked lime, stirring occasionally for a few hours; then let it settle, pour off the clear liquid, and boil 2 pounds tallow in it until all the tallow is dissolved. Cool it in a flat box, and cut it into bars or cakes. It can be scented by stirring in the desired perfume when cool.

548. To Make Home-made Caustic Soda. Dissolve 6 pounds common washing soda in 4 gallons warm water; slack 6 pounds clean fresh quicklime in a tub, using only as much water as is needed to crumble it perfectly; add the slacked lime to the solution of soda; stir the two together, adding 4 gallons boiling water; stir thoroughly and let it settle; then pour off the clear lye for use.

549. To Make Domestic Soap. Put the caustic soda lye, prepared in the manner and quantity given in the last receipt, into a clean iron kettle, and add, during continual stirring, 12 pounds clarified grease, dusting in, a little at a time, 4 ounces finely powdered borax; let it boil gently for 10 or 15 minutes, until it thickens and becomes ropy; then have in readiness a tight box, lined with a piece of muslin large enough to hang well over the sides, to allow of the contents being afterward conveniently lifted out; pour the mixture from the kettle into the box, and let it stand for a few days to harden; when sufficiently firm, turn it out onto a table, and cut it into bars with a thin wire. Soap thus made, and left to harden in a dry room, will be fit for use in a month.

550. To Make Home-made Caustic Lye from Ashes. Provide a box whose sides terminate in a point, and having an orifice at the lower end (*see illustration*); this should be mounted high enough to allow of a vessel being placed underneath it, to receive the liquid that runs out of the bottom. The box is then well lined with straw (*see No.* 607), upon which fresh wood ashes are placed, adding to the ashes about one twentieth the quantity of fresh slacked lime (*see No.* 519); then pour hot water upon it, and the lye will filter through into the vessel below. For the purposes of soap-making, this lye must be concentrated by boiling until a sound potato will not sink below the surface.



551. To Make Home-made Soap. Fill an iron kettle two-thirds full of the concentrated lye prepared according to the last receipt; add to it melted fat, a ladleful at a time, stirring constantly until the mass becomes creamy; next add small quantities of salt at a time, stirring without intermission until a perfect ring can be made on the surface with a stick; then let the fire go out and the soap will rise to the surface and harden as it cools; the lye can be drawn from under it by tilting the kettle, or the soap may be lifted off and laid out to dry until hard enough to cut it into bars. (*See No.* 549.)

552. Ox-gall Soap. Gall soap, for the washing of fine silken cloths and ribbons, is prepared in the following manner: In a vessel of copper 1 pound cocoanut oil is heated to 60° Fahr., and ½ pound caustic soda is added, with constant stirring. In another vessel ½ pound white Venetian turpentine is heated, and when quite hot, stirred into the copper kettle. This kettle is then covered and left for 4 hours, being gently heated, after which the fire is increased until the contents are perfectly clear; then 1 pound ox-gall is added. After this, sufficient perfectly dry Castile soap is stirred into the mixture to cause the whole to yield but little under the pressure of the finger; for which purpose, from 1 to 2 pounds of soap are required for the above quantity. After cooling, the soap is cut into pieces. It is excellent, and will not injure the finest colors.

Toilet Soaps.

To this class belong the finer kinds of scented soaps, which have emollient properties. They are rarely made direct by the perfumer, the body or basis being a well-selected white soap, subsequently cleaned and purified. For the choicest grades, the body should be made of a mixture of olive and sweet-almond oil, as the fat stock. Lard and beef tallow make the next best stock; and for palm soap a small quantity of bleached palm oil is to be added to them. Cocoa oil and pale yellow resin saponaceous matters also enter into the composition of certain toilet soaps. These body soaps may be obtained as wanted from any well-conducted soap factory. To be adapted to the purposes of perfumery they must be perfectly neutral, firm, free from unpleasant odor and all tendency to *crust* in cold, or *sweat* in damp weather. They should, moreover, give a rich lather without wasting too rapidly in the water. Soaps, generally, in their original condition, are usually deficient in many of those points; and must, for the purposes of perfumery, undergo a refining process, which is as follows:

554. To Refine Soap for Making Toilet Soap. The soap, as purchased in bars or blocks, being piled upon the shelf of the rasping machine, is next placed in the hopper, and as the wheel revolves, knives come against the soap and cut it into meal, which falls into the reception box beneath. It is now in a state fit to be melted readily, for which purpose it is transferred to a steam bath, and mixed with rose and orange-flower waters, each half a gallon, to every hundred pounds of soap. The steam being let on, and the containing kettle covered, its contents become gradually fluid, and in this state must be stirred with a *crutch*—which is a long stick having the form of an inverted T—until the paste becomes uniformly consistent and smooth throughout. It is then allowed to cool, again melted, but without fragrant water, and crutched as before. When the contents of the vessel comprise several kinds of soap, great care must be observed not to put in all at once, but to add and melt each successively, and to crutch constantly, so as to effect an intimate mixture. When the paste begins to cool, coloring matter as may be desired is then added, and subsequently the perfume, which is reserved to the last, to avoid any unnecessary loss by evaporation from the hot paste.

555. To Perfume, Cut and Stamp Toilet Soap. When extracts or bouquets are used, they must be added to the compound in meal, and incorporated with the mass by kneading it with the hands; for the application of heat would impair the delicacy of the odor, as well as occasion loss by its evaporation. In large establishments this is done by passing the meal repeatedly between marble rollers.

The soap is now ready to be put into the cooling frames, which is a rectangular well, made of a series of wooden frames, resting successively one upon the other. In a day or two it is sufficiently hard to be cut into tablets of the size of the sections of each frame; they are set up edgewise, and left for several days to dry, and are then barred by means of a wire. The sections or *lifts* of the frames regulate the width of the bars, and the gauges adjust their breadth—these latter being made so as to cut bars or squares of four, six, eight or any required number to the pound of soap. The bars are further subdivided into tablets, and subjected to pressure for the purpose of imparting solidity, and ornamenting the exterior with some appropriate device, or impressing upon it the maker's name; the shape of the tablet being determined by the form of the mould or die-box in which it is pressed. The press is of ordinary construction, with spiral springs to throw out the soap tablet from the die-box as soon as it is pressed. In some factories the pressure is more effectually accomplished by means of a steam hammer, which is made to give three blows, directly vertical, to each tablet of soap. Savonettes or soap-balls are shaped by rotating blocks of soap upon a soap scoop made of brass, with sharp edges.

556. **To Marble Soap.** The mottled or marble appearance is usually given to soap, on the large scale, by watering the nearly finished soap with a strong lye of crude soda (preferably one rich in sulphurets), by means of a watering-pot furnished with a rose-spout. In Castile soap it is given with a solution of sulphate of iron, used in the same way. On the small scale, with toilet soaps, the mottle is either given in the way noticed under *"Mottled Soap Balls"* (*see No.* 576), or, in a like manner, by combining some of the soap, colored at the time of scenting it, with the remaining uncolored portion.

557. **Almond Soap.** This is a very white soap, which, when genuine, is made by the cold process (*see Nos.* 582 *and* 583), and from pure oil of sweet almonds. The kind, however, generally met with, is made as follows: White curd soap, 100 pounds; cocoanut oil, 15 pounds; purified as before directed (*see No.* 554), and perfumed with a mixture of attar of bitter almonds, 1½ pounds; and attars of cloves and caraway, each 8 ounces.

558. **White Windsor Soap.** The genuine old white Windsor is made from a body of which a mixture of lard and olive oil is the fat stock; and attars of caraway, lavender, and rosemary, constitute the perfume.

The modern Windsor soap is made from fine white curd soap, 115 pounds; cocoanut-oil soap, 20 pounds; perfumed with a mixture of attar of caraway, 1½ pounds; attars of thyme and rosemary, each 8 ounces; and attars of cassia and cloves, each 4 ounces.

559. **Brown Windsor Soap.** Curd soap, 100 pounds; cocoanut oil soap, and pale yellow resin soap, each 25 pounds; color with caramel (*see No.* 694), 8 ounces; and perfume with a mixture of attars of caraway, cloves, thyme, cassia, petit-grain, and lavender, each 8 ounces. Morfit's oleic soap, of first grade, is peculiarly adapted as a body for brown Windsor soap, as it gives a rich lather, and is very smooth and highly emollient. Moreover, it contains its normal moisture for a great length of time.

560. **Honey Soap.** White curd soap, 40 pounds; melted and crutched with white honey, 10 pounds; storax, 2 pounds; and powdered benzoin, 1 pound.

561. **Imitation Honey Soap.** An imitation honey soap is made by melting together pale yellow soap, 100 pounds; soft soap, 14 pounds; and perfuming with attar of citronella, 1½ pounds.

562. **Frangipani Soap.** Curd soap, colored brown with caramel, 7 pounds; perfumed with a mixture of attars of neroli and vitivert, each 4 ounces; attar of rose, 2 drachms; attar of santal, 1½ ounces; and civet, 2 drachms. The latter is to be previously triturated with the attars.

563. **Rose Soap.** This is made from a mixture of olive oil soap, 60 pounds; and curd soap, 40 pounds; colored with 1 pound of finely bolted vermilion. The perfume consisting of attar of rose, 6 ounces; attars of santal and geranium, each 1 ounce; and tincture of musk, 8 ounces; must be added to the cold soap in meal, and incorporated by kneading. The oil soap may be replaced by curd soap, but the quality of the rose soap will not then be so fine.

564. **Savon au Bouquet.** White soap, 60 pounds; perfumed in the cold with 8 ounces of extract bouquet; or in warm paste with a mixture of attar of bergamot, 8 ounces; attars of cloves and sassafras, each ½ ounce; attar of thyme, 1 ounce; attar of neroli, 1 ounce. The soap body must be previously colored brown with 1 pound of caramel. The soap scented with the attars is inferior to that perfumed with extract bouquet. The perfume, and with it the title of the soap, can be varied according to the caprice of fashion.

565. **Poncine Soap.** Curd soap, 50 pounds; cocoanut oil soap, the same quantity, melted to paste and crutched with 10 or 20 pounds of finely bolted pumice-stone powder. The perfume is a mixture of attars of thyme, cassia, caraway, and lavender, each 1 pound.

566. **Spermaceti Soap.** The genuine spermaceti soap is superior to all others in emollient properties; but it is rarely made from pure stock, owing to the difficulty in saponifying it. As generally vended it consists of white curd soap, 14 pounds; perfumed with a mixture of attar of bergamot, 2½ ounces, and attar of lemon, 8 ounces.

567. **Palm Soap.** Curd soap, made of a mixture of ½ lard, ⅛ bleached palm oil, and the remainder olive oil or spermaceti, constitutes the body of palm soap. Its natural odor is that of the violet, which is sometimes stimulated by the addition of a little attar of portugal, with a less portion of attar of cloves.

568. **Floating Soap.** All the hard soaps increase bulk by mechanical batting of the paste; the loss of density thus produced gives them the property of floating in water. The batting is best accomplished by means of a churn-twirl, rotating on a pivot in the bottom of the melting pan, and put in motion by a handle.

Expose 5 pounds olive-oil or almond soap, and 1¼ pints soft water in a bright copper pan, to a steam or water heat, and assiduously beat and agitate the mixture until it has more than double its volume; then pour it into a cold frame, cool it quickly, and, when hard, cut it into bars or cakes. It may be colored and scented at will. Floats on water, and lathers freely, but will not bear soaking or much wet, as it rapidly softens.

569. **Transparent Soap.** This amber-looking soap is made by dissolving hard white soap, previously reduced to meal and thoroughly dried, in alcohol. A steam-bath, fitted with a still-head, makes a good containing vessel. The alcohol and soap are taken in about equal proportions; and, as the solution proceeds, any spirit which may distill over must be allowed to condense in a worm, and collected in a receiver. The heat should not exceed 212°. After solution, the whole

must be allowed time for settling; after which, the clear fluid is to be drawn off from the sediment into wooden frames; or globular moulds of britannia metal, if it is desired to cast it in ball form. Previous to settling it may be colored as desired—red, with tincture of alkanet; yellow, with tincture of turmeric; orange, with a mixture of the two tinctures; green, with tincture of chlorophyle; blue, with tincture of indigo carmine. Transparent soap is rather translucent when first made, and does not clear until perfectly dry. The perfumes are the same as for the other soaps.

570. Glycerine Soap. Any mild toilet soap (as the basis of bouquet, rose, or Windsor soap) with which about $\frac{1}{25}$ to $\frac{1}{20}$ of its weight of Price's glycerine has been intimately incorporated whilst in the melted state. It is generally tinged of a red or rose color, with a little tincture of archil or of dragon's blood; or orange yellow, with a little annatta. It is variously scented; but oil of bergamot, or rose-geranium (ginger-grass), supported with a little oil of cassia, or cassia supported with essential oil of almonds, appear to be its favorite perfumes.

571. Musk Soap. Best tallow soap, 30 pounds; palm oil soap, 20 pounds; powdered cloves, pale roses and gilliflowers, of each 4½ ounces; essence of bergamot and essence of musk, of each 3½ ounces; Spanish brown, 4 ounces.

572. Orange Flower Soap. Best tallow soap, 30 pounds; palm oil soap, 20 pounds; essence of portugal and essence of ambergris, each 7½ ounces; yellowish green coloring, made of ochre and indigo, 8¼ ounces; vermilion, 1¼ ounces.

573. Cinnamon Soap. This is usually a mixture of tallow and oil soaps, like that of "savon au bouquet," colored with about ¼ pound yellow ochre, and scented with 1 ounce oil of cinnamon (supported with a little oil of bergamot and sassafras), to each 7 pounds. The following is the form of a celebrated maker of this soap, and is very fine:

6 pounds finest white curd soap; 3½ pounds finest palm oil soap; 1 pound olive oil soap; 1½ ounce oil of cinnamon; ¼ ounce oil of bergamot; ¼ ounce oil of sassafras; 1 drachm English oil of lavender; and about ¼ pound levigated yellow ochre.

Oil of cassia is commonly substituted for the oil of cinnamon; and always so in second and inferior qualities.

574. Glycerine Soap Balls. To any recently made toilet soap, sliced, and melted by a gentle heat, without water (if possible), add Price's glycerine, in the proportion of 1 ounce to the pound; thoroughly incorporate them by vigorous stirring, which should be continued until the mass has cooled considerably, when it should be at once made into balls.

575. Sand Soap Balls. These are prepared by adding to the melted soap about half its weight of fine siliceous sand. Sifted sand is usually employed. Some persons prefer the shelly sea-sand (sifted from the shells and well washed) for the purpose. For the finer qualities, finely-powdered pumice-stone is now usually employed. Used to prevent roughness and thickening of the skin in cold weather; also to clean the hands when dirty. The best yellow soap, with or without the addition of ⅛ its weight of white soft soap and a little sweet oil, is the best for these balls.

576. Mottled Soap Balls. Cut the soap (recently prepared, and not too dry) into dice, or small square pieces, roll them in colored powder (*see below*), and then mould them into balls by powerful pressure, observing to mix the colors as little as possible.

The colors usually employed, and which should be in very fine powder, are: *Blue*—indigo, powder-blue, or smalts. *Green*—powder-blue and bright yellow-ochre. *Orange*—yellow deepened with a little red. *Red*—red bole, sesquioxide of iron, or jeweler's rouge. *Yellow*—bright yellow-ochre, or Dutch pink.

By varying the shade of color, which is done by diluting it with a little farina or chalk, and by using soap-dice separately coated with two or more colors, "mottled savonettes" of any color, or mixture of colors, may be produced at will.

577. Mercurial Soap. Take of corrosive sublimate (crushed small), 1 drachm; rectified spirit (to dissolve, say) 1 fluid ounce; white Castile soap (in powder), 4 ounces; beat them to a uniform mass in a wedgwood-ware mortar, adding a few drops of attar of roses, or of a mixture of the oils of cassia and bitter almonds. Nothing metallic must touch it. This is the "sapo hydrargyri bichloridi" of medical writers. The above has been recommended in various skin diseases, including itch; also as "Savon Antisyphilitique," under which name it is often sold.

578. Sulphur Soap; Sulphuretted Soap. Take ½ pound white curd or Castile soap (recent); 1 ounce best flowers of sulphur (levigated); 1 fluid ounce rectified spirit (strongly colored with alkanet); and sufficient attar of roses to strongly scent the mass. Beat the whole together, to a smooth paste, in a marble or wedgwood ware mortar. This is Sir H. Marsh's formula. Recommended in itch, and various other skin diseases. It is particularly serviceable as a common toilet soap, to persons troubled with slight cutaneous eruptions. Its daily use tends to render the skin fair and smooth. The spirit and coloring may be omitted at will; and, as a toilet soap, only half the above quantity of sulphur is amply sufficient.

579. Caution in using Medicated Soaps. Before using mercurial or sulphur soap, finger-rings, ear-rings, and bracelets of gold, &c., should be removed, and not replaced until some short time after the hands have become quite dry; as otherwise they will be tarnished, and even blackened and corroded. The same applies to all other cosmetics containing the same mineral ingredients.

580. Whale-oil Soap to Destroy Insects. Render common lye caustic, by boiling it at full strength on quicklime; then take the lye and boil it with as much whale-oil foot as it will saponify (change to soap), pour off into moulds, and, when cold, it is tolerably hard. Whale-oil foot is the sediment produced in refining whale oil.

581. Carbolic Acid Soap. Take freshly prepared cocoanut-oil soap, 150 parts, and fuse;

then add a solution of alcohol, 10 parts; carbolic acid, 6 parts; caustic potassa, 2 parts; oil of lemon, 1 part; and mix with stirring. To be poured into moulds.

Soap by the Cold Process.

Although the commoner kinds of soap are usually made by boiling, they can be made by the cold process if desired; and the fatty substances employed are substantially the same in both methods. The cold or little-pan process is, however, almost exclusively adopted in the manufacture of fancy or toilet soaps, and for these purposes the fat requires to be purified and deodorized, especially where any delicate scent is to be used in perfuming it. (*See Nos.* 533 *and* 530.) The lye employed for saponification without boiling must be much stronger than that used in the boiling process, and should be entirely clear and colorless; a strength of about 36° Baumé is usually necessary.

583. To Make Soap by the Cold Process. Incorporate by degrees 50 pounds concentrated caustic lye of 36° Baumé, into 100 pounds fat at a temperature not higher than 104° Fahr. (*see No.* 523); continue to stir thoroughly with a broad wooden paddle, until a complete ring can be drawn on its surface with the paddle. In making scented soap, the perfuming ingredients must now be stirred in. The paste is then run into frames lined with linen, flaps of which should be left above the edges of each frame, wide enough to admit of their being laid over the surface of the paste, with which the frame must be *entirely* filled. The paste being thus completely confined by the linen, the frames are closed with a wooden cover and left for 12 hours. During this interval the temperature of the paste in the frames rises spontaneously to a much higher degree, producing complete saponification. The soap is afterwards taken out of the frames, cut, and dried. The hardness of the soap will depend on the description of fats and lyes used. (*See No.* 521.)

584. Method of Testing Caustic Alkali. The strength and practical value of commercial caustic soda or potash can only be ascertained by analysis. The methods given below are simple, and will determine, with sufficient accuracy, the percentage of water, caustic alkali, and carbonated alkali contained in a given sample; and hence the quantity of impurity, if any.

585. To Find the Percentage of Water in a Caustic Soda or Potash. Weigh carefully 100 grains of the alkali into a capsule (a flat evaporating dish of suitable size, a watch glass is a small capsule), and dry them by heating over a flame; a cold glass held over the contents of the capsule will show the slightest evaporation of water. When no more moisture can be detected, allow them to cool; then weigh the residue in the capsule, and the difference of the weights before and after drying will be the number of grains of water contained in 100 grains of the alkali; that is, the percentage of water.

586. To Estimate the Percentage of Caustic Alkali in a Caustic Soda or Potash. Powder 100 grains of the alkali to be tested; put it into a flask containing an ounce of 95° alcohol, and shake thoroughly; the alcohol dissolves the caustic alkali perfectly, but will not take up any other ingredients. After standing for a few hours to settle, decant the clear liquid, and evaporate on a porcelain capsule until thoroughly dry; the weight of the dry residue will be the number of grains, *i. e.*, the percentage, of caustic alkali in 100 grains of the soda or potash.

587. To Find the Percentage of Carbonated Alkali in a Caustic Soda or Potash. Dissolve 100 grains of the sample in 4 ounces water in a flask; next weigh out 100 grains finely powdered crystals of oxalic acid; add small portions of this acid at a time to the alkali in the flask, stirring thoroughly with a glass rod, and apply heat; continue to add the acid until the hot mixture tinges litmus paper slightly red; the saturation is then complete, and the acid has neutralized or combined with *all* the alkali, both carbonate and caustic. Weigh the oxalic acid which remains; and, by deducting from 100, we know how much we have used. Now every 7.87 grains oxalic acid that have been used, have neutralized 5 grains soda or 7 grains potash, according as the sample consists of caustic soda or caustic potash; hence we find the total number of grains of *alkali* in the 100 grains under test. By the previous method we can find the percentage of *caustic alkali* in 100 grains of the sample; deducting the grains of this latter from the weight of the whole alkali eliminated by the oxalic acid, the balance or remainder will be the percentage of *carbonated alkali.*

By these three steps we get the percentage of water, the percentage of caustic alkali, and the percentage of carbonated alkali; these added together and deducted from 100 give the percentage of foreign matter or impurity in the matter tested. (*See Alkalimetry.*)

588. To Make Soap-makers' Concentrated Caustic Lye. Boil 85 gallons water in a kettle capable of holding 150 gallons; stir in, a little at a time, 100 pounds powdered soda (or potash, if for potash lye), until it is all dissolved; then mix in gradually, by stirring, 48 pounds freshly slacked lime of a creamy consistency; the boiling must not be allowed to slacken during the whole process, until complete causticity is obtained, which may be ascertained by taking a little in a test glass, and, *when cool,* adding to it a few drops of nitric acid; if this causes effervescence, the causticity is imperfect and the boiling must be continued until a test with nitric acid causes no effervescence. When this is the case, the contents of the kettle should be allowed to cool and settle for about 12 hours. The clear liquor can then be drawn off into a vat lined with lead—a syphon may be used for this purpose with advantage. The lye can be made to any desired strength by evaporation.

589. To Make Concentrated Caustic Soda Lye—Kurten's Method. The lye fit for toilet soap must be either made from the purest German soda at 95 degrees of strength, or (which is better for the purpose) from crystallized soda. English soda of 80 to 83 degrees, such as is generally found in commerce, is not to be used, as it produces a bad article.

When the lye for finer soap is to be made, 100 pounds lime are added to 100 pounds German soda at 95 per cent., whereas 45 pounds lime to 100 pounds crystallized soda is the general proportion.

The soda is dissolved in the boiler with water, or with a weak lye remaining from a former operation at 20 degrees of strength, and afterwards added to the lime slacked to a state like broth. This mixture must boil 2 hours and be left to deposit.

The next day, the lye, which probably may be at 12 degrees (Baumé) must be taken out, and the boiler filled afresh. The lye drawn from the lime and at 8 degrees, is poured in with it to evaporate. By this method a lye is produced at a medium of 9 or 10 degrees, but it must be evaporated till, according to areometer, it shows 34 degrees. After the cooling it will weigh 36 pounds. This evaporation of the lye is to increase its causticity, and to cause all the dirt contained in it to precipitate to the bottom, which can be done in a day if it is sufficiently strong.

The clear lye is then drawn off from the dirty deposit, and put either into vitriol bottles or into an iron vessel well covered. If vitriol bottles are used, they must be filled with water in which some lime has been dissolved, to take away any acid remaining in the bottle, which would, if this precaution be not taken, absorb much of the causticity of the lye; and this must be done several days before using the bottles. The dirt and deposit from the salt remaining at the bottom after the boiling, can be added to the lime in the weak lyes.

We have not made the experiment of using the lye stronger than 11 degrees before evaporation, as we have learned from France that it must not be stronger than 11 degrees. Yet, after mature experience, it appears to us now that a lye can be obtained quite as good by adding more soda and lime to the lye, and thus increasing the strength to 18 or 20 degrees, by which the evaporation is spared. In this case more vessels are wanted, which must not be of wood, but of iron, because the wood will color the lye, which must be especially avoided for fine soap, for the only means of obtaining a perfect soap, free from defect, is to use none except the finest and whitest lye, and oil or grease of the greatest purity.

590. To Test Lye. In testing the strength of lyes with a hydrometer, an exact result could be obtained if the caustic alkali employed by soap-makers and dyers were absolutely pure; but as this is seldom, if ever, the case, the impurities which exist in the lyes under examination, influence the specific weight of the lye, and due allowance must be made for this; thus, an indication by the hydrometer of 20 per cent. does not prove that the lye contains 20 per cent. of pure caustic alkali, but includes the foreign matter. Still, this method of testing will give *comparative* strengths exactly.

591. White Soap. Lard, 40 pounds; and caustic soda lye, of 35° Baumé, 20 pounds. Melt the fat by a heat not exceeding 150° Fahr.; add, during constant stirring, 10 pounds of the lye. After one hour's stirring, the heat being continued all the time at a moderate degree, the remaining 10 pounds of lye are to be added. When the paste has become smooth and uniform throughout, it is transferred to a cooling frame, perfumed, and left in a room of moderate temperature for a few days to set and ripen. It is then ready to be cut into tablets and pressed.

592. Almond Soap. Genuine almond soap is made from oil of sweet almonds, 50 pounds, and soda lye of 36° Baumé, 25 pounds, the latter being gradually added to the former at a temperature between 125° to 150°, and the whole stirred constantly until the mixture is a smooth paste. It is then transferred to a cooling frame, perfumed with attar of bitter almonds, and then left for several days to set and ripen.

593. Ordinary Cocoanut Oil Soap. 100 pounds cocoanut oil—or 90 pounds cocoanut oil and 10 pounds of either tallow or palm oil—saponified by the cold process with 225 pounds caustic soda lye of 21° Baumé, and 75 pounds of salt water of 12° Baumé, will combine to form 400 pounds of cocoanut oil soap.

594. Cocoanut Oil Soap. 100 pounds cocoanut oil and 56 pounds caustic soda lye of 36° Baumé, treated according to the cold process, will produce 153 pounds cocoanut oil soap.

595. Paris Toilet Tablet Soap. 87 pounds of this soap can be made by the cold process by using the following ingredients: 20 pounds tallow, 30 pounds cocoanut oil, 8 pounds lard, 31 pounds caustic soda lye of 36° Baumé, and 5 pounds caustic potash lye of the same strength.

596. Paris Toilet Round Soap. 25 pounds cocoanut oil, 75 pounds lard, 50 to 52 pounds caustic soda lye of 36° Baumé, will produce 150 pounds of the soap.

597. Shaving Soap. Either 66 pounds tallow and 34 pounds cocoanut oil—or 33 pounds of tallow, the same quantity of palm oil, and 34 pounds cocoanut oil—treated by the cold process with 120 pounds caustic soda lye of 27° Baumé, will make 214 pounds of shaving soap. An addition of 12 pounds of salt water of 12° Baumé to the palm oil mixture, will add 12 pounds to the yield of soap.

598. Washing Soap. A mixture of either 60 pounds tallow—or 30 pounds each of tallow and palm oil—with 40 pounds of cocoanut oil, treated by the cold process with 125 pounds caustic soda lye of 27° Baumé, and 25 pounds salt water of 12° Baumé, will turn out 244 pounds washing soap.

599. Cheap Washing Soap. 60 pounds cocoanut oil with 40 pounds of either tallow or palm oil, treated cold with 135 pounds caustic soda lye of 27° Baumé, and 50 pounds salt water of 15° Baumé, will produce 278 pounds washing soap.

Soft Soaps.

These differ from the hard soaps in having potash in place of soda as their alkaline base. They are all more or less pasty or gelatinous; and they may be made either by the boiling or cold process. Of the soft soaps used in perfumery, that known as fig soap is the only one that is boiled.

601. Fig Soap. The fat stock is chiefly oil—generally olive oil—with the addition of a little tallow to give it the granular appearance called fig.

602. Shaving Cream. This is made by melting 20 pounds of lard in a steam bath at a temperature of 212°, and then letting 5 pounds of caustic potassa lye of 36° Baumé run in *very slowly*, during constant stirring with a wooden paddle; when the paste becomes thick, 5 pounds more of lye are added in the same manner. After several hours' stirring the paste becomes firm, and is finished. It is then transferred to a mortar and triturated until the soap becomes perfectly even throughout, and assumes a pearly appearance. Attar of almonds is the perfume for almond cream; and attar of rose for rose cream. They are dissolved in a little alcohol, and added during the trituration. The rose cream is colored at the same time with tincture of alkanet.

603. Rypophagon Soap. This is a mixture of equal parts of pale yellow resin soap and fig soft soap, perfumed with attars of anise and citronella.

604. Essence of Soap or Shaving Cream. Take ¼ pound white soft soap (*see No.* 606), 2 fluid drachms liquor of potassa; 1 pint rectified spirit, and perfume at will; put them into a strong bottle of glass or tin, cork it close, set it in warm water for a short time, and occasionally agitate it briskly until solution be complete. After repose, pour off the clean portion from the dregs (if any) into clean bottles for use, and at once closely cork them. If the solution be not sufficiently transparent, a little rectified spirit should be added to it before decantation. A little spirit (fully proof) may be added if it be desired to render it thinner. If much essential oil be used to perfume it, the transparency of the product will be lessened.

605. Soft Olive Oil Soap; Medicinal or Toilet Soft Soap is soap made of olive oil and potash. It is yellowish-white, inodorous, and of the consistence of thick honey. It is the soft soap (sapo mollis) of the British Pharmacopœia.

606. White Soft Soap is soap made of lard and potash. Only used in cosmetics and as a toilet soap.

607. Fine Shaving Cream. Take of clarified lard, 7 pounds (avoirdupois); potash lye (26 per cent. of caustic potash), 3¾ pounds; rectified spirits, 3 ounces; oil of bitter almonds, 2 drachms. Melt the lard in a porcelain vessel, by a salt-water bath; then run in the lye, very slowly, agitating the whole time; when about half the lye is in, the mixture begins to curdle; it will, however, become so firm that it cannot be stirred. It will assume a pearly appearance by triturating in a mortar, and slowly adding the alcohol, holding the oil of almonds in solution. This furnishes a splendid shaving cream.

608. To Make Good Common Soft Soap. For a barrel of soap take 12 pounds of potash to 14 pounds of grease. Dissolve the potash over night in 2 pailfuls of hot soft water, in the morning pour it hot over the grease, which must have been previously rendered down and put in the barrel, put more water on the potash that remains undissolved; when hot, add as before, and so on until all the potash is dissolved; fill up the barrel more slowly with cold water, finishing it the next day; stir it very frequently during the day and for several successive days. Allow it to rest for three months in the cellar.

609. Shaker Method of Making Soft Soap. Place a shallow iron kettle, to hold from 4 to 6 barrels, just out of the wash-room, under cover of a shed. Extend ½ or ¾ inch pipe for steam to the middle of the bottom, bending it to form of surface, and terminating with open end. Take another pipe to discharge cold water over the top of the kettle. Use the best quality of first sorts of potash, in the proportion of 6 pounds of potash to 7 pounds of grease, for a barrel of 40 gallons. Break up the potash into small lumps, and dissolve it in say 2 pails of hot water to 24 pounds. It dissolves rather slowly when the potash is good. When dissolved, put the solution into the kettle, add the grease quite warm, and stir the mixture together. Allow it to stand over night, if convenient. In the morning, apply a moderate jet of steam until the mixture appears ropy, or rather soapy. Shut off the steam and open the cold water valve, stirring the mixture as the water runs, until the kettle is full, or the required quantity obtained for the materials used.

610. To Make Good Lye. Hickory ashes are the best for making common washing soft soap (when it is not desirable to use the potash lye), but those from sound beech, maple, or almost any kind of hard wood, except oak, will answer well. A common barrel, set upon an inclined platform, makes a very good leach, but one made of boards set in a trough in V shape is to be preferred, for the strength of the ashes is better obtained, and it may be taken to pieces when not in use, and laid up. First, in the bottom of the leach put a few sticks; over them spread a piece of carpet or woolen cloth, which is much better than straw; put on a few inches of ashes, and from 4 to 8 quarts lime; fill with ashes, moistened, and tamp down well—tamp the firmest in the centre. It is difficult to obtain the full strength of ashes in a barrel without removing them after a day's leaching, and mixing them up and replacing. The top should be first thrown off, and new ashes added to make up the proper quantity. Use boiling water for second leaching. This lye should be sufficiently strong to float a potato.

611. To Make Soft Soap. Take about 4 gallons the above lye, and boil up thoroughly with 12 pounds of clear grease, then add the lye as it is obtained, keeping a slow fire, and stirring often, until you have a barrel of soap. After boiling the grease and 4 gallons of lye together, it may be put in a barrel and the rest of the lye added there, which will form good soap if frequently stirred, but the heating process is the best when weather and time will permit the work to be done.

612. To Make Soft Soap. Break up 8 pounds potash into small lumps, and put it into an iron pot with about 3 gallons boiling water; melt in another iron pot 8 pounds clarified fat; put 3 or 4 gallons hot water into a clean barrel, and add to it a ladleful each of the lye and the fat; stir thoroughly, and add the lye and the fat, a single ladleful of each at a time, until the whole is thoroughly mixed; then stir in a ladleful of hot water at a time until the barrel is full, and stir till the mixture becomes a creamy mass; put it away for 3 months in a moderately cool place and it will be ready for use.

613. To Make Turpentine Soap. Cut up 3 pounds brown soap and melt it in 7 quarts water, then put it in a stone pot and add 9 table-spoonfuls spirits of turpentine and 6 of alcohol.

614. To Use Turpentine Soap. Make very hot suds with some of the soap (*see last receipt*), and let the clothes remain in it half an hour. Then wash them out and rinse as other clothes are done. It is particularly nice for blankets and quilts, as it removes the dirt and requires very little rubbing.

615. To Make Soft Soap Hard. Put into a kettle 4 pailfuls of soft soap, and stir in it, by degrees, about 1 quart of common salt. Boil until all the water is separated from the curd, remove the fire from the kettle, and draw off the water with a syphon (a yard or so of india rubber hose will answer). Then pour the soap into a wooden form in which muslin has been placed. (*See No.* 549.) For this purpose, a wooden box, sufficiently large and tight, may be employed. When the soap is firm, turn it out to dry, cut into bars with a brass wire and let it harden. A little powdered resin will assist the soap to harden, and give it a yellow color. If the soft soap is very thin, more salt must be used.

616. Labor-saving Soap. Take 2 pounds sal soda, 2 pounds yellow bar soap, and 10 quarts water. Cut the soap in thin slices, and boil together 2 hours; strain, and it will be fit for use. Put the clothes in soak the night before you wash, and to every pail of water in which you boil them, add a pound of soap. They will need no rubbing; merely rinse them out, and they will be perfectly clean and white.

617. To Estimate the Quality of Soap. The quality of soap may be properly estimated from the amount of fatty acids which any given specimen contains. The following simple analysis may be performed by any one, and may be relied upon as giving good results. The soap to be examined should be dissolved in water. If distilled water cannot be readily obtained, rain water will answer well enough. When a perfect solution is obtained, add hydrochloric acid. After a little while the fatty acids will be found to be separated from the other constituents of the soap. These should be collected, and their relative weight for any given quantity estimated. The relative weight thus found will be a sufficiently just indication of the quality.

618. To Test Soap. The readiest way to find whether soap will injure the delicate skin of women or children is to test it with the tongue. Good soap, in which the caustic alkali is neutralized by thorough combination with the fat, will not have a sharp taste. The soap used in medicine, and the transparent soaps, are neutral and good. Many toilet soaps, and especially the imitation marbled castile soap, so abundant in the trade, contain too much free alkali. They have not been thoroughly boiled, and are very sharp. It is not advisable to use such soaps upon delicate skins, as they induce redness of appearance, and give the skin a tendency to roughen or chap, especially when exposed to the wind.

619. To Pulverize Hard Soap. Hard bar soap should be scraped or planed into fine shavings, dried in the sun, or by heat, thoroughly, and then pounded or crushed. After this, it should be placed in a bowl or kettle, and a small cannon ball should be used to pulverize it; when thoroughly pulverized it may be sifted through a very fine sieve.

620. To Analyze Soap. Take a small portion of the soap, place it in a suitable vessel (a beaker glass), add ether to it, and next acetic acid in a somewhat smaller quantity. The liquid will separate, after a while, into two distinct layers, the upper of which contains in solution the fatty acids, while the lower layer contains the alkalies and salts, and such substances as might happen to be insoluble in the two fluids just named. By means of a pipette, the fluids are separated from each other. The ethereal solution is poured into a previously weighed beaker glass, and the ether evaporated upon a water bath, and next again weighed with the fatty acids it contains. The aqueous acetic acid is evaporated to dryness, and the quantity of alkali determined according to well-known methods. (*See No.* 586).

621. Analysis of Soda and Potassa Lyes. The following tables will show at a glance all the practical information necessary for analyzing or testing the strength of lyes, either simple or caustic, as well as affording thorough guidance in mixing or adjusting the strength of lye for any specific purpose.

622. Lormé's Tables. The following tables are used to transform stronger lyes into weaker of a definite degree of strength, and are by Mr. Eugène Lormé.

The first column at the left of each table shows the quantity and the degree of the lye to be diluted.

The second indicates the quantity of water to be added to the lye.

The third gives the amount of the lye obtained by the admixture of both liquids.

The fourth exhibits the degrees of Baumé's areometer of the lye.

623. Table showing the different Areometric Degrees resulting from a mixture of 10 gallons of soda lye, of 36 degrees Baumé, with quantities of water varying from 10 to 90 gallons.

Number of gallons of Lye of 36 degrees.	Number of gallons of Water.	Number of gallons of obtained Lye.	Degrees of Baumé of the mixture.
10	10	20	23°
10	20	30	17
10	30	40	14
10	40	50	12
10	50	60	10
10	60	70	9
10	70	80	8
10	80	90	7¼
10	90	100	6¾

10 gallons of lye, of 36 degrees Baumé, weigh 112½ lbs.

624. Table showing the different Areometric Degrees resulting from a mixture of 10 pounds of soda lye, of 36 degrees Baumé, with quantities of water varying from 10 to 90 pounds.

Number of pounds of Lye of 36 degrees.	Number of pounds of Water to be employed.	Number of pounds of Lye obtained.	Degrees of Baumé of the mixture.
10	10	20	21°
10	20	30	14½
10	30	40	11½
10	40	50	10
10	50	60	9
10	60	70	8
10	70	80	6½
10	80	90	5½
10	90	100	5 nearly

8.8 gallons of lye, of 30 degrees Baumé, weigh 100 pounds.

625. Table showing the different Areometric Degrees resulting from a mixture of 10 gallons of soda lye, of 30 degrees Baumé, with quantities of water varying from 10 to 90 gallons.

Number of gallons of Lye of 30 degrees.	Number of gallons of Water to be employed.	Number of gallons of Lye obtained.	Degrees of Baumé of the mixture.
10	10	20	19°
10	20	30	nearly 14
10	30	40	11
10	40	50	9
10	50	60	8
10	60	70	7
10	70	80	6
10	80	90	5
10	90	100	4½

10 gallons of soda lye, of 30 degrees, weigh 104 pounds; 75 gallons of this lye and 25 gallons of water give 100 gallons of lye of 25 degrees Baumé. There are 23¼ pounds of caustic soda wanted for making 10 gallons of lye of 30 degrees Baumé.

626. Table showing the different Areometric Degrees resulting from a mixture of 10 pounds of soda lye, of 30 degrees Baumé, with quantities of water varying from 10 to 90 pounds.

Number of pounds of Lye of 30 degrees.	Number of pounds of Water to be employed.	Number of pounds of Lye obtained.	Degrees of Baumé of the mixture.
10	10	20	17°
10	20	30	12
10	30	40	9½
10	40	50	7½
10	50	60	6½
10	60	70	5½
10	70	80	5 or 5½
10	80	90	4½
10	90	100	4

9.6 gallons of lye, of 30 degrees Baumé, weigh 100 pounds.

627. Gerlach's Table, showing the percentage of Carbonate of Soda contained in its Solutions.

Per cent.	Specific Weight.	Per cent.	Specific Weight.
1	1.00914	27	1.26787
2	1.01829	28	1.27893
3	1.02743	29	1.28999
4	1.03658	30	1.30105
5	1.04572	31	1.31261
6	1.05513	32	1.32417
7	1.06454	33	1.33573
8	1.07396	34	1.34729
9	1.08337	35	1.35885
10	1.09278	36	1.37082
11	1.10258	37	1.38279
12	1.11238	38	1.39476
13	1.12219	39	1.40673
14	1.13199	40	1.41870
15	1.14179	41	1.43104
16	1.15200	42	1.44338
17	1.16222	43	1.45573
18	1.17243	44	1.46807
19	1.18265	45	1.48041
20	1.19286	46	1.49314
21	1.20344	47	1.50588
22	1.21402	48	1.51861
23	1.22459	49	1.53135
24	1.23517	50	1.54408
25	1.24575	51	1.55728
26	1.25681	52	1.57048

628. Schiff's Table, showing the percentage of Crystallized and Anhydrous Soda in Solutions of Carbonate of Soda.

Specific Weight.	Per cent. of Crystallized Soda.	Per cent. of Anhydrous Soda.
1.0038	1	0.370
1.0076	2	0.741
1.0114	3	1.112
1.0153	4	1.482
1.0192	5	1.853
1.0231	6	2.223
1.0270	7	2.594
1.0309	8	2.965
1.0348	9	3.335
1.0388	10	3.706
1.0428	11	4.076
1.0468	12	4.447
1.0508	13	4.817
1.0548	14	5.188
1.0588	15	5.558
1.0628	16	5.929
1.0668	17	6.299
1.0708	18	6.670
1.0748	19	7.041
1.0789	20	7.412
1.0830	21	7.782
1.0871	22	8.153
1.0912	23	8.523
1.0953	24	8.894
1.0994	25	9.264
1.1035	26	9.635
1.1076	27	10.005
1.1117	28	10.376
1.1158	29	10.746
1.1200	30	11.118
1.1242	31	11.488
1.1284	32	11.859
1.1326	33	12.230
1.1368	34	12.600

Schiff's Table (Continued).

Specific Weight.	Per cent. of Crystallized Soda.	Per cent. of Anhydrous Soda.
1.1410	35	12.971
1.1452	36	13.341
1.1494	37	13.712
1.1536	38	14.082
1.1578	39	14.453
1.1620	40	14.824
1.1662	41	15.195
1.1704	42	15.566
1.1746	43	15.936
1.1788	44	16.307
1.1830	45	16.677
1.1873	46	17.048
1.1916	47	17.418
1.1959	48	17.789
1.2002	49	18.159
1.2045	50	18.530

629. Table showing the percentage of Anhydrous Potassa in Caustic Potassa Lye.

Specific Gravity.	Potassa in 100.	Specific Gravity.	Potassa in 100.
1.3300	28.290	1.1437	14.145
1.3131	27.158	1.1308	13.013
1.2966	26.027	1.1182	11.882
1.2805	24.895	1.1059	10.75
1.2648	23.764	1.0938	9.619
1.2493	22.632	1.0819	8.487
1.2342	21.500	1.0703	7.355
1.2268	20.935	1.0589	6.224
1.2122	19.803	1.0478	5.002
1.1979	18.671	1.0369	3.961
1.1838	17.540	1.0260	2.829
1.1702	16.408	1.0153	1.697
1.1568	15.277	1.0050	0.5658

630. Table showing the percentage of Caustic Soda in Soda Lye.

Specific Gravity.	Per cent.	Specific Gravity.	Per cent.
1.4235	30.220	1.2392	15.110
1.4193	29.616	1.228	14.506
1.4101	29.011	1.2178	13.901
1.4011	28.407	1.2058	13.297
1.3923	27.802	1.1948	12.692
1.3836	27.200	1.1841	12.088
1.3751	26.594	1.1734	11.484
1.3668	25.989	1.1630	10.879
1.3586	25.385	1.1528	10.275
1.3505	24.780	1.1428	9.670
1.3426	24.176	1.1330	9.066
1.3349	23.572	1.1233	8.462
1.3273	22.967	1.1137	7.857
1.3198	22.363	1.1042	7.253
1.3143	21.884	1.0948	6.648
1.3125	21.894	1.0855	6.694
1.3053	21.154	1.0764	5.540
1.2982	20.550	1.0675	4.835
1.2912	19.945	1.0587	4.231
1.2843	19.341	1.0500	3.626
1.2775	18.730	1.0414	3.022
1.2708	18.132	1.0330	2.418
1.2642	17.528	1.0246	1.813
1.2578	16.923	1.0163	1.209
1.2515	16.319	1.0081	.604
1.2453	15.814	1.0040	.302

To Make Home-made Tallow Candles. Tallow candles are made in two different forms; the mould candle is the easiest to make, but involves the expense of a mould made expressly for the purpose; the dip candle requires more trouble, but no apparatus to make it; the first cost, however, of a candle mould is fully compensated for by the superiority of the candles made by it over those made by dipping.

632. To Make Candle Wicks. The wicks are composed of cotton yarn (what is known as No. 16 is a good size for the purpose); for candles of 8 to the pound, about 40 threads, and for 6 to the pound, about 50 threads of yarn should be very loosely twisted together. The light from a tallow candle can be improved in clearness and brilliancy by using small wicks which have been dipped in spirit of turpentine and thoroughly dried.

633. To Make Mould Candles. The wicks are secured in the centre of each mould by passing over thin sticks, one of which is laid over the top of the mould (corresponding to the bottom of the candles), and the other against the bottom points of the moulds. The end of the twisted wick is fastened to the stick on the top of the mould, and is drawn by a piece of hooked wire, through each mould in succession, leaving a loop outside the bottom points of the mould; the loops are secured there by the bottom stick passing through them; the wicks are to be drawn tight and the last end tied to the upper stick. The melted tallow is then poured into the moulds and allowed to stand about 6 hours in a cool place, after which the bottom stick must be taken out of the loops, and the candles withdrawn from the moulds. The tallow should not be heated much more than is necessary to melt it.

634. To Make Dip Candles. Dip candles are made by looping a number of separate wicks over a rod, and dipping them into very liquid tallow, until the required thickness is attained, allowing the tallow which adheres after each dipping to set or harden before dipping again. Before the second dip, it is well to lay the wicks on a flat surface, and straighten them, and a suitable contrivance adopted for holding the rod while drying between the dips.

635. Tallow for Making Candles. A good tallow for candles consists of about ⅓ beef and ⅔ mutton suet. If required for summer use it will be improved by hardening according to receipts No. 639 or 640; it can, if needed, be so hardened as to have almost the appearance of stearine. (*See No.* 638.)

636. To Make Lard Candles. To every 8 pounds of lard add 1 ounce of nitric acid. Having carefully weighed the lard, place it over a slow fire, or at least merely melt it; then add the acid, and mould the same as tallow; this makes a clear, beautiful candle. A small proportion of beeswax will make them harder.

637. To Harden Tallow Candles. The following mixtures for hardening tallow candles are patented in England. The candles are successively and rapidly dipped, first in Mixture I., which consists of stearic acid, 50 parts; tallow, 44 parts; camphor, 3 parts;

white resin, 2 parts; and gum damar, 1 part. When cool and hard they are dipped into Mixture II., which consists of stearic acid, 70 parts; tallow, 24 parts; camphor, 3 parts; white wax, 2 parts; gum damar, 1 part; and finally into Mixture III., which is composed of stearic acid, 90 parts; tallow, 5 parts; camphor, 3 parts; white wax, 2 parts.

638. **To Harden Tallow by Capaccioni's Process.** Melt 1000 parts tallow, and gradually stir into it 7 parts sugar of lead previously dissolved in water, being careful to keep the mass constantly agitated during the process. In a few minutes diminish the heat, and add 15 parts incense (powdered) with 1 part turpentine, keeping the mass constantly stirred as before. Then allow the mixture to remain warm until the insoluble parts of the incense settle to the bottom, usually several hours. By this process the sugar of lead so hardens the tallow that it yields a material very similar to stearine (stearic acid), while the incense improves its odor. It is said that tallow treated in this way, when made into candles, will not gutter or run.

639. **To Harden and Whiten Tallow for Summer Use.** Gently boil the tallow with the addition of a little beeswax, 1 or 2 hours a day for 2 days, in a suitable kettle, adding *weak* lye and skimming often; cut it out of the pot when cold, and scrape off the underneath soft portion, adding fresh but weak lye before the second boiling. The third day simmer, and skim it, in water containing 1 pound of alum and 1 pound saltpetre for each 30 pounds of tallow. When cold it can be taken off the water for use. Tallow thus treated will make good hard white candles for summer purposes.

640. **To Harden Tallow for Making Candles.** Use 1 pound of alum for each 5 pounds of tallow. Dissolve the alum in water, then put in the tallow and stir until both are melted together, then run in moulds. Candles made in this way will be as hard and white as wax.

641. **To Harden Tallow with Resin.** To 1 pound tallow take ½ pound common resin; melt them together, and mould the candles the usual way. This will give a candle of superior lighting power, and as hard as a wax candle; a vast improvement upon the common tallow candle, in all respects except color.

Tanning.

When the skin of an animal, carefully deprived of hair, fat, and other impurities, is immersed in a dilute solution of tannic acid, the animal matter gradually combines with the acid as it penetrates inwards, forming a perfectly insoluble compound, which resists putrefaction completely; this is tanned leather. In practice, lime water is used for cleansing and preparing the skin; water acidulated with oil of vitriol (sulphuric acid) for raising or opening the pores; and an infusion of oak bark or some other astringent matter for the source of the tannic acid. The process is necessarily a slow one, as dilute solutions only can be safely used. Skins intended for curriers, to be dressed for "uppers," commonly require about 3 weeks; thick hides, suitable for sole-leather, take from 12 to 18 months. Various modifications have been introduced into the process, for the purpose of reducing the time required for tanning, but so far with only moderate success, as the leather so produced is spongy and inferior in quality.

643. **Morocco Leather** is prepared from goat or sheep skins; which, after the action of lime water and a dung bath, are slightly tanned in a bath of sumach, and subsequently grained and dressed.

644. **Russia Leather** is generally tanned with a decoction of willow bark, after which it is dyed, and curried with the empyreumatic oil of the birch tree. It is this oil which imparts to Russia leather its peculiar odor, and power of resisting mould and damp.

645. **To Tan any kind of Fur Skins.** This will be found an excellent plan for tanning any kind of skin with the fur on. After having cut off the useless parts, and softened the skin by soaking, remove the fatty matter from the inside and soak it in warm water for an hour. Next, mix equal parts of borax, saltpetre, and glauber salts (sulphate of soda), in the proportion of about ½ ounce of each for each skin, with sufficient water to make a thin paste; spread this with a brush over the inside of the skin, applying more on the thicker parts than on the thinner: double the skin together, flesh side inwards, and place it in a cool place. After standing 24 hours, wash the skin clean, and apply, in the same manner as before, a mixture of 1 ounce sal soda, ½ ounce borax, and 2 ounces hard white soap, melted slowly together without being allowed to boil; fold together again and put away in a warm place for 24 hours. After this, dissolve 4 ounces alum, 8 ounces salt, and 2 ounces saleratus, in sufficient hot rain water to saturate the skin; when cool enough not to scald the hands, soak the skin in it for 12 hours; then wring out and hang it up to dry. When dry repeat this soaking and drying 2 or 3 times, till the skin is sufficiently soft. Lastly, smooth the inside with fine sand paper and pumice stone.

646. **To Tan Sheep's Pelts with the Wool On.** Wash the pelts in warm water, and remove all fleshy matter from the inner surface; then clean the wool with soft soap, and wash clean. When the pelt is perfectly free from all fatty and oily matter, apply the following mixture to the flesh side, viz.: For each pelt take common salt and ground alum, ¼ pound each, and ½ ounce borax; dissolve the whole in 1 quart hot water, and when sufficiently cool to bear the hand, add rye meal to make it like thick paste, and spread the mixture on the flesh side of the pelt. Fold the pelt lengthwise, and let it remain 2 weeks in an airy and shady place; then remove the paste from the surface, wash, and dry. When nearly dry, scrape the flesh side with a crescent-shaped knife. The softness of the pelt depends much on the amount of working it receives.

647. **To Prepare Sheep Skins for Mats.** Make a strong lather with hot water, and let it stand till cold; wash the fresh skin in it, carefully squeezing out all the dirt from the wool; wash it in cold water till all the soap is taken out. Dissolve a pound each

salt and alum in 2 gallons hot water, and put the skin into a tub sufficient to cover it; let it soak for 12 hours, and hang it over a pole to drain. When well drained, stretch it carefully on a board to dry, and stretch several times while drying. Before it is quite dry, sprinkle on the flesh side 1 ounce each of finely pulverized alum and saltpetre, rubbing it in well. Try if the wool be firm on the skin; if not, let it remain a day or two, then rub again with alum; fold the flesh sides together and hang in the shade for 2 or 3 days, turning them over each day till quite dry. Scrape the flesh side with a blunt knife, and rub it with pumice or rotten stone. Very beautiful mittens can be made of lamb skins prepared in this way.

648. To Tan Muskrat Skins with the Fur On. First wash the hide in warm water, and remove all fatty and fleshy matter. Then soak it in a liquor prepared as follows: To 10 gallons cold soft water add 8 quarts wheat bran, ½ pint old soap, 1 ounce borax; by adding 2 ounces sulphuric acid the soaking may be done in one-half the time. If the hides have not been salted, add 1 pint salt. Green hides should not be soaked more than 8 or 10 hours. Dry ones should soak till very soft. For tan liquor, to 10 gallons warm soft water add ½ bushel bran; stir well and let stand in a warm room till it ferments. Then add slowly 2½ pounds sulphuric acid; stir all the while. Muskrat hides should remain in about 4 hours; then take out and rub with a fleshing knife—(an old chopping knife with the edge taken off will do.) Then work it over a beam until entirely dry.

649. To Cure Rabbit Skins. Lay the skin on a smooth board, the fur side undermost, and fasten it down with tinned tacks. Wash it over first with a solution of salt; then dissolve 2½ ounces alum in 1 pint of warm water, and with a sponge dipped in this solution, moisten the surface all over; repeat this every now and then for three days; when the skin is quite dry, take out the tacks, and rolling it loosely the long way, the hair inside, draw it quickly backwards and forwards through a large smooth ring, until it is quite soft, then roll it in the contrary way of the skin, and repeat the operation. Skins prepared thus are useful for many domestic purposes.

650. To Clean Furs. Furs may be cleaned as follows:—Strip the fur articles of their stuffing and binding, and lay them as much as possible in a flat position. They must then be subjected to a very brisk brushing, with a stiff clothes brush; after this, any moth-eaten parts must be cut out, and be neatly replaced by new bits of fur to match.

651. To Clean Dark Furs. Sable, chinchilla, squirrel, fitch, &c., should be treated as follows: Warm a quantity of new bran in a pan, taking care that it does not burn, to prevent which it must be actively stirred. When well warmed, rub it thoroughly into the fur with the hand. Repeat this two or three times; then shake the fur, and give it another sharp brushing until free from dust.

652. To Clean Light Furs. White furs, ermine, &c., may be cleaned as follows: Lay the fur on a table, and rub it well with bran made moist with warm water; rub until quite dry, and afterwards with dry bran. The wet bran should be put on with flannel, and the dry with a piece of book-muslin. The light furs, in addition to the above, should be well rubbed with magnesia, or a piece of book-muslin, after the bran process. Or dry flour may be used instead of wet bran. Ermine takes longer than Minevar to clean. They should be rubbed against the way of the fur.

653. To Improve Furs by Stretching. Furs are usually much improved by stretching, which may be managed as follows: To 1 pint of soft water add 3 ounces salt; dissolve; with this solution sponge the inside of the skin (taking care not to wet the fur) until it becomes thoroughly saturated; then lay it carefully on a board with the fur side downwards, in its natural disposition; then stretch as much as it will bear, and to the required shape, and fasten with small tacks. The drying may be quickened by placing the skin a little distance from the fire or stove.

654. To Preserve Furs and Woolen Clothing from Moth. Moths deposit their eggs in the early spring. This, therefore, is the time to put away furs and woolens for the summer. It is not the moth, but the maggot of the moth that does the mischief with furs and woolens. To effectually preserve them from the ravages of these insects, thoroughly beat the furs with a thin rattan, and air them for several hours, then carefully comb them with a clean comb, wrap them up in *newspapers*, perfectly tight, and put them away in a thoroughly tight chest lined with tin, or cedar wood. Take them out and examine them in the sun at least once a month, thoroughly beating them. This, indeed, is the secret of the fur-dealers in preserving their stock. Camphor, which is so much used to preserve furs, impairs their beauty by turning them light. The printing ink on the newspapers is just as effectual as camphor, being very distasteful to the moth. The above method may also be adopted to preserve feathers, and all kinds of woolen clothing, omitting, of course, the combing; camphor may be sprinkled among the woolens.

655. To Clean Ostrich Feathers. Cut some white curd soap in small pieces, pour boiling water on them, and add a little pearlash. When the soap is quite dissolved, and the mixture cool enough for the hand to bear, plunge the feathers into it, draw the feathers through the hand till the dirt appears squeezed out of them, pass them through a clean lather with some blue in it, then rinse in cold water with blue to give them a good color. Beat them against the hand to shake off the water, and dry by shaking them near a fire. When perfectly dry, curl each fibre separately with a blunt knife or ivory paper-folder.

656. To Clean Grebe. Carefully take out the lining, and wash it in the same way as directed for the ostrich feathers. They must not be shaken until quite dry, and any rent in the skin must be repaired before making up again.

657. To Clean Swansdown. White swansdown may be washed in soap and water; after washing, shake it out, and when the down is somewhat raised, shake it before a clear fire to dry.

658. To Curl Feathers. Heat them slightly before the fire, then stroke them with the back of a knife, and they will curl.

659. To Cleanse Feathers from Animal Oil. Mix well with 1 gallon clear water, 1 pound quicklime; and, when the lime is precipitated in fine powder, pour off the clear lime-water for use. Put the feathers to be cleaned in a tub, and add to them a sufficient quantity of the clear lime-water to cover them about 3 inches. The feathers, when thoroughly moistened, will sink down, and should remain in the lime-water for 3 or 4 days; after which, the foul liquor should be separated.

660. To Deodorize Skunk Skins, or articles of clothing scented, hold them over a fire of red cedar boughs, and sprinkle with chloride of lime; or, wrap them in green hemlock boughs, when they are to be had, and in 24 hours they will be deodorized.

661. To Stiffen Bristles. These are usually stiffened by immersing for a short time in cold alum water.

662. To Dye Bristles. Bristles are dyed by steeping them for a short time in any of the common dyes used for cotton or wool.

Imitation Liquors.

The liquors generally met with for sale and consumption are, it is well known, rarely genuine; and even if genuine, are often adulterated with water and various deleterious compounds. The imitations of liquor innocently imbibed by the unsuspecting as wholesome stimulants, contain, too freqently, combinations that are most hurtful, if not actually poisonous. Receipts are here given for making imitation liquors, which are at least as wholesome as genuine spirits, and contain no ingredient that can hurt the system more than alcohol itself does. They are the receipts furnished by a practical French chemist, who has made this business a specialty for some thirty years.

664. Prune Flavoring for Liquors. Mash 25 pounds prunes, infuse for 15 days with 6 gallons proof spirit, stirring it every day; press and filter.

665. Raisin Flavoring for Liquors. Subject 25 pounds mashed raisins to the same process as the prunes in the last receipt.

666. St. John's Bread Flavoring for Liquors. Cut 50 pounds St. John's bread into small pieces. Infuse for 15 days with 12 gallons proof spirits, stirring every day; filter.

667. Orange Peel Flavoring for Liquors. Steep 1 pound orange peel in 1 gallon 95 per cent. alcohol for 15 days; filter.

668. Vanilla Flavoring for Liquors. Slice 1 drachm vanilla in small pieces; infuse for 20 days in 1 pint 95 per cent. alcohol; filter.

669. Orris Root Flavoring for Liquors. Infuse 2 ounces powdered orris root for 20 days in 1 quart 95 per cent. alcohol, and filter.

670. Sassafras Flavoring for Liquors. Granulate ½ pound sassafras bark, and infuse it in ½ gallon 95 per cent. alcohol for 20 days; filter.

671. Hickory Nut Flavoring for Liquors. Crush 1 bushel hickory nuts, and infuse for 1 month in 12 gallons 95 per cent. alcohol; strain and filter.

672. Flavoring Compound for Brandy. Mash 25 pounds raisins, 12 pounds prunes, 6 pounds figs, and 1 pineapple sliced; infuse for 15 days in 20 gallons proof spirits, stirring every day, and then filter.

673. Coffee Flavoring for Liquors. Infuse 1 pound ground roasted coffee in 1 gallon 95 per cent. alcohol. This is used in combination with other flavors for brandy.

674. Peach Flavoring for Whiskey. Steep for 1 month, 10 gallons dried peaches, 10 gallons oak saw-dust, and 5 pounds black tea in 40 gallons proof spirits; strain and filter.

675. How to Prepare Essence of Cognac. Take 1 ounce oil cognac—the green oil is the best; put it in ½ gallon 95 per cent. spirits. Cork it up tight, shake it frequently for about 3 days; then add 2 ounces strong ammonia. Let it stand 3 days longer; then place in a stone jar that will contain about 3 gallons, 1 pound fine black tea, 2 pounds prunes, having first mashed the prunes and broken the kernels. Pour on them 1 gallon spirits 20 above proof. Cover it close, and let it stand 8 days. Filter the liquor, and mix with that containing the oil and ammonia. Bottle it for use. This makes the best flavoring known for manufacturing brandies, or for flavoring cordials, syrups, etc. The above proportion should flavor 100 gallons brandy.

676. To Imitate Brandy with Essence of Cognac. Take 1 pint essence of cognac (*see No.* 675), 15 gallons pure spirits (very fine) 20 per cent. above proof, ½ pint plain white syrup. Color with caramel.

677. Simple Test for Alcohol in Oil of Cognac. Take a half ounce phial or test tube, and fill it *exactly* half full of oil of cognac; then fill up the remaining space with water, and shake it well. The alcohol, if there be any present, having a much greater affinity for water than for the oil, will leave the oil and combine with the water; denoting, by the decrease in the bulk of the oil, or the increase in that of the water, the quantity of alcohol present. Other tests for essential oils will be found under its heading. (*See Index.*)

678. Highly Flavored Domestic Brandy. To 40 gallons French proof spirits, add 2 quarts raisin flavoring (*see No.* 665), 2 quarts prune flavoring (*see No.* 664), 2 quarts St. John's bread flavoring (*see No.* 666), 1 gallon best sherry wine, 2 drachms oil of cognac and 20 drops oil of bitter almonds, both dissolved in a little 95 per cent. alcohol; 1 gallon Jamaica rum (or ¼ ounce Jamaica rum essence), and 2 pints wine vinegar. Ten gallons of this mixture, mixed with 30 gallons French spirits, make an excellent domestic brandy, and 1 pound of glycerine gives it age.

679. Imitation Cognac Brandy. To 36 gallons French proof spirits, add 4 gallons Pellevoisin or Marette cognac, ½ gallon best sherry or Madeira wine, and 20 drops oil of cognac, dissolved in a little 95 per cent. alcohol. Then pour 2 quarts boiling water over 2 ounces black tea; when cold, filter through flannel, and add a little maraschino; mix this with the other ingredients, and color the whole to suit, with caramel. (*See No.* 694.)

Another excellent formula is as follows: Dissolve 20 drops oil of cognac and 15 drops oil of bitter almonds in a little 95 per cent. alcohol; add it to 40 gallons 60 per cent. French spirit, with 2 pints tincture of raisin, 2 pints tincture of prunes, 3 pints best Jamaica rum, 3 pints best sherry wine, and ½ ounce acetic ether. Color with caramel.

680. Imitation Brandy. Take 40 gallons French spirit; add to it 1 pint tincture of raisins (*see No.* 665), 1 quart prune flavoring (*see No.* 664), ½ gallon best sherry or Madeira wine, and 1 pint wine vinegar. Then add 1 drachm oil of cognac, 12 drops oil of bitter almonds, ⅛ to ½ drachm tannin powder, each dissolved separately in 95 per cent. alcohol. Color to suit with caramel. (*See No.* 694.)

681. Imitation French Brandy. To 40 gallons French proof spirit, add 1 quart tincture of orris root (*see No.* 669), 1 pint vanilla flavoring (*see No.* 668), ½ gallon best sherry or Madeira wine, and 1 pint wine vinegar. Dissolve separately, 1 drachm oil of cognac and 12 drops oil of bitter almonds, each in a little 95 per cent. alcohol, and add them to the mixture, coloring the whole to suit with caramel. (*See No.* 694.)

682. Imitation Pale Brandy. Infuse 1 drachm star-anise (breaking the star only) for 8 hours in ½ pint 95 per cent. alcohol, and filter; add this to 40 gallons proof spirits; then add ½ gallon best Jamaica rum, and 1 pint of the best raspberry syrup. Dissolve 1 drachm oil of cognac, and 12 drops oil of bitter almonds, separately, in a little 95 per cent. alcohol, and mix them with the whole.

683. Imitation Bourbon Whiskey. Mix together 40 gallons proof spirits, ½ gallon peach flavoring (*see No.* 674), ½ gallon hickory nut flavoring (*see No.* 671), ½ gallon highly flavored brandy (*see No,* 678), 1 pint wine vinegar, and 1 pint white glycerine. Add to these 12 drops oil of cognac dissolved in 95 per cent. alcohol, and color with caramel. (*See No.* 694.)

Or: 36 gallons proof spirits, 4 gallons highly flavored proof rye whiskey, 1 gallon domestic brandy (*see No.* 680), together with the same proportions of vinegar, glycerine, and oil of cognac, as before.

684. Imitation Bourbon Whiskey. To 36 gallons proof spirits, add 4 gallons highly flavored proof Bourbon, 1 gallon New England rum, ½ gallon sweet Catawba wine (or 1 quart sherry wine), and 1 pound white glycerine. Color to suit with caramel. (*See No.* 694.)

685. Imitation Bourbon Whiskey. 36 gallons proof spirit, 4 gallons highly flavored proof Bourbon, 1 gallon malt whiskey, 1 pint wine vinegar, 1 pint syrup, and 12 drops oil of cognac dissolved in 95 per cent. alcohol. Color with caramel. (*See No.* 694.)

686. Imitation Bourbon Whiskey. To 40 gallons proof spirit, add 1 gallon hickory flavor (*see No.* 671), 1 gallon domestic brandy (*see No.* 680), 1 pint wine vinegar, and 1 pound white glycerine, with 12 drops oil of cognac dissolved in 95 per cent. alcohol, and caramel (*see No.* 694) sufficient to color.

687. Imitation Copper-Distilled Bourbon Whiskey. Dissolve 1 drachm sulphate of copper in ½ pint water, filter, and add it to 40 gallons proof spirit, with 1 gallon peach flavor (*see No.* 674), 1 gallon brandy flavor (*see No.* 672), 1 pint wine vinegar, 1 pound white glycerine, and 12 drops oil of cognac dissolved in 95 per cent. alcohol. Color with caramel. (*See No.* 694.)

688. Imitation Rye Whiskey. To 40 gallons proof spirit, add 2 gallons peach flavoring (*See No.* 674), 1 pint white vinegar, and 12 drops oil of cognac in 95 per cent. alcohol. Color with caramel. (*See No.* 694.)

689. Imitation Sweet Rye Whiskey. 30 gallons proof spirit, 10 gallons proof rye whiskey, and 1 gallon raisin flavor (*see No.* 665), colored with sufficient caramel. (*See No.* 694).

690. Imitation Irish Whiskey. 36 gallons French spirits 20 above proof, 4 gallons Scotch (Ramsay) whiskey, 3 pints best sherry wine, 2 pints syrup, and 10 drops sassafras flavor. (*See No.* 670.)

691. Imitation Scotch Whiskey. 36 gallons French spirits 20 above proof, 4 gallons Scotch whiskey, and 1 quart syrup.

692. To Impart a Smoky flavor to Whiskey. The simplest way to impart this peculiar flavor to whiskey is by preparing the barrel. Insert securely a large sheet-iron funnel into the bung-hole of a dry 40-gallon barrel; provide a small open furnace, containing a charcoal fire; put 1 pound of birch bark on the fire, and support the barrel, with its funnel downwards, over the furnace, so that the funnel, which should be considerably wider than the furnace, will receive the smoke from the bark. When the bark ceases smoking, remove the funnel and bung the barrel up tight. After it has stood 24 hours, put the spirit in the barrel, and keep it there for 36 hours, frequently rolling the barrel, in order that the spirits may be thoroughly impregnated with the smoke and smoky deposit on the inside of the barrel. The spirits will then be found to have acquired the desired flavor. Creosote, diluted with alcohol, is sometimes used to impart the smoky flavor to spirits.

693. To Give the Appearance of Age to Brandy Barrels. Dissolve in 3 gallons water, 3 pounds sulphuric acid and 1 pound sulphate of iron. Wash the barrels with it on the outside.

694. To Make Caramel. Dissolve 7 pounds crushed sugar in 1 pint water; boil it in a 5-gallon copper kettle, stirring occasionally until it gets brown; then reduce the fire and let the sugar burn until the smoke makes the eyes water. When a few drops, let fall into a tumbler of cold water, sink to the bottom and harden sufficiently to crack, it is done. Then pour on it, by degrees, about 2 quarts warm water, stirring all the time. When well mixed, filter it hot through a coarse flannel filter. Some use lime-water to dissolve the burnt sugar. Care must be taken not to overburn it, as a greater quantity is thereby rendered insoluble. The heat should not exceed 430°, nor be under 400° Fahr. The process for nice experiments is best conducted in a bath of melted tin, to which a little bismuth has been added, to reduce its melting point to about 435°; a little powdered resin or charcoal, or a little oil, being put upon the surface of the metal, to prevent oxidation.

695. **To Plaster Brandy Pipes.** First notch over the bottom of the casks with a hatchet or adze; then, for the bottom of a ⅛ pipe mix ¼ gallon plaster with 1 gallon water, and pour it on; while the plaster is setting, tap the cask gently with a mallet, in order that the plaster may penetrate into every crevice. When the plaster is fully set, wash it over with a wet sponge. If you wish to color the plaster, add a little Venice red.

696. **Wax Putty for Leaky Casks, Bungs, &c.** Melt 8 pounds yellow wax and 12 pounds solid turpentine over a slow fire; add 4 pounds tallow; and, when thoroughly mixed, remove the whole to a distance from the fire and stir in 2 pounds spirits of turpentine, and let it cool.

697. **Imitation Schiedam Gin.** Dissolve 3½ drachms oil of juniper in sufficient 95 per cent. alcohol to make a clear liquid; add it to 40 gallons French spirits 10 above proof, with 8 ounces orange peel flavoring (*see No.* 667), 1 quart syrup, and 30 drops oil of sweet fennel.

698. **Imitation Old Tom London Gin.** Dissolve in 1 quart 95 per cent. alcohol, 1 drachm oil of coriander, 1 drachm oil of cedar, ½ drachm oil of bitter almonds, ½ drachm oil of angelica, and ½ drachm oil of sweet fennel; add it to 40 gallons French spirit 10 above proof, with 1 pint orange-flower water, 1 quart syrup, and 1 drachm oil of juniper dissolved in sufficient 95 per cent. alcohol to be clear.

699. **Imitation Santa Cruz Rum.** 35 gallons New England rum, 5 gallons Santa Cruz rum, and 1 drachm vanilla flavoring. (*See No.* 668.)

700. **Imitation Batavia Arrack.** 35 gallons French spirit (rice spirit is preferable), 5 gallons Batavia arrack, ½ ounce balsam of tolu, and ½ ounce tincture of flowers of benzoin.

701. **Imitation Batavia Arrack.** To 12 gallons pale rum add 2 ounces flowers of benzoin, 1½ ounces balsam of tolu, 1 sliced pineapple. Digest with occasional agitation for a month; then add ½ pint raw milk. Agitate well for 15 minutes, and rack in a week. A fine imitation.

702. **Imitation Jamaica Rum.** 20 gallons spirit 10 above proof, 20 gallons New England rum 10 above proof, ½ pound Jamaica rum essence, 1 gallon St. John's bread flavoring (*see No.* 666), and 1 pound white glycerine. Color to suit with caramel. (*See No.* 694.) Or:—40 gallons spirit 10 above proof, 1 pound Jamaica rum essence, 10 drops oil of cloves, 1 gallon St. John's bread flavoring (*see No.* 666), and 1 pound white glycerine. If desired, there may be added 1 ounce gum kino and ½ drachm oil of caraway, each dissolved in 2 ounces 95 per cent. alcohol.

703. **To Make Spirit Finings.** Pulverize 1 pound ordinary crystals of alum, divide into 12 equal portions, and put up in blue papers marked No 1. Next take 6 ounces carbonate (the ordinary sesquicarbonate) of soda, divide it into 12 parts and put them up in white papers marked No. 2. In place of the 6 ounces carbonate of soda, 4 ounces dry salt of tartar may be substituted, but the white papers containing this latter substance must be kept in a dry, well corked bottle or jar.

704. **To Clarify Gin or Cordials.** To clarify from 30 to 36 gallons gin, dissolve the contents of one of the blue papers, as prepared in No 703, in about a pint of hot water, and stir it into the liquor thoroughly. Then dissolve the contents of one of the white papers in about ½ pint hot water, and stir well into the liquor; bung the cask close, and let the whole remain till the next day.

705. **To Blanch Gin or other White Liquor.** By using double the quantity of finings, that is, 2 of each of the powders, as laid down in the foregoing receipt, the liquor will be blanched as well as clarified. It is well to recollect, however, that the more finings are employed, the greater the risk of injuring the liquor, which may have a tendency to become flat when "on draught."

706. **Finings for Gin.** To 100 gallons gin, take 4 ounces roche alum, and put it into 1 pint of pure water; boil it until it is dissolved, then gradually add 4 ounces salts of tartar; when nearly cold put it into the gin, and stir it well with a staff for 10 minutes. The liquor must not be covered until it is fine; when this is accomplished, cover it up tight to prevent it from losing its strength.

707. **To Remove the Blackness from Gin.** Some gin has a particular blackness; to remove which, take 1 ounce pulverized chalk and 2 or 3 ounces isinglass, dissolved; put this into the gin and it will become transparent. The above is enough for 50 gallons. The blackness which gin sometimes contracts by coming in contact with iron, may also be carried down by putting a solution of 2 ounces isinglass and 1 quart skimmed milk into the spirit. When the color is very black, which will happen by merely an iron nail having fallen into the liquor, there is no remedy but to have the liquor distilled over again.

708. **To Clarify Stained Gin.** When gin has once become much stained, the only remedy is to re-distill it; when it is only slightly stained the addition of a few pounds acetic acid to a pipe or butt, 1 or 2 spoonfuls to a gallon, or a few drops to a decanterful, will usually decolor it.

709. **Brandy Filter.** When necessary to filter an imitation brandy, an excellent utensil may be used for that purpose which has already been described. (*See No.* 17, *fig.* 5.) It will, however, be necessary to substitute cotton wadding in place of the charcoal.

710. **To Make Rum Punch.** Dissolve in 1 pint 95 per cent. alcohol, 3 drachms oil of lemon, and ½ drachm oil of cloves; infuse 3 ounces ground allspice for 10 days in 1 quart 95 per cent. alcohol, and filter it. Mix these with 18 gallons spirit 30 above proof, 2 gallons Jamaica rum, and 1 pound Jamaica rum essence (or 20 gallons New England rum 30 over proof and ½ pound Jamaica rum essence). Next add 2½ pounds tartaric acid dissolved in 2½ gallons water, and 18 gallons syrup made of 108 pounds white sugar. Color with caramel. (*See No.* 694.)

711. **To Make Wine Punch.** Dissolve 2½ drachms oil of lemons and ½ drachm oil of cloves in 95 per cent. alcohol; make an infusion of 3 ounces ground allspice, as in last receipt; add these to 10 gallons proof spirit,

10 gallons Marsala or Catalonia wine, 10 gallons syrup made of 35 pounds white sugar, and ½ pound tartaric acid. If not red enough, add a little cherry juice. Filter.

712. To Make Wine Punch. To 10 gallons proof spirit, add 10 gallons Marsala or Catalonia wine. Take 10 gallons syrup made of 35 pounds sugar; peel the rind, thinly, of 120 lemons; bring the syrup to a boil, and simmer the lemon rinds in it for ½ hour or more, then strain it through a fine flannel. Mix all the above with the juice of the lemons. Instead of boiling the lemon peel in the syrup, it may be infused for 5 or 6 days in 95 per cent. alcohol. The color can be deepened with cherry juice. Brandy, rum, whiskey and arrack punch may be made as above, substituting the liquor for the wine and spirits.

Champagne. The process of making American and imitation French champagne is one requiring great care, especially in producing a not only clear, but bright wine. Full directions are given below for making the necessary syrup, mixing the ingredients, fining, filtering and gassing; including a number of receipts for different kinds of champagne. A careful attention to the instructions laid down will produce wines which will compare favorably with the best genuine importations.

714. To Make a Filter for Filtering Wines. A filter for wines is usually made of felt, shaped like a cone or sugar loaf; those without any seam are the best. A lining of paper pulp is prepared in the following manner: Tear from 2 to 4 sheets filtering paper into small pieces and put it into a pail; pour over it a little boiling water, sufficient, by thorough beating, to form a fine smooth paste; then add sufficient water to fill the filter. Pour this quickly into the filter, and, 5 minutes after the water has drained through, fill up with the wine to be filtered, taking care to keep the filter always full.

715. To Make Syrup for Champagne Wine. To 25 pounds white sugar, add 2 gallons water and the whites of 4 eggs; stir until the sugar is dissolved. Let the whole simmer to the candy degree; then strain it through a bag made of fine flannel.

716. To Prepare Isinglass for Fining Wines. Cut up some isinglass (it must be of the very best quality), and put it in a jar, with just enough wine or water to cover it; add daily as much of the wine or water as has been absorbed by the isinglass. In 6 or 8 days it should be completely dissolved, forming a thick fluid mass. Squeeze it through a linen cloth and put it into a bottle, adding 4 or 5 per cent. of 95 per cent. alcohol to make it keep. For 40 gallons wine to be fined, take 1 wine-glassful of dissolved isinglass, add a little wine and a pinch of salt, and beat to a froth with a whisk, adding by degrees sufficient wine to make the mixture up to ½ gallon. When foaming, pour it slowly into the wine, stirring till all the fining is incorporated with the wine. Isinglass thus prepared and used will precipitate completely; and, after a few days, the wine will be bright. Too much care cannot be taken in the preparation of fining, as even the finest isinglass contains fibrous matter which dissolves with difficulty; this is very apt to remain suspended in the wine, and is not visible until developed, after bottling, by the gas with which the wine is afterwards charged.

717. To Prepare Champagne Wine for Charging. Put the wine used to make the champagne into a cask, add the brandy spirit, the aroma or flavoring, and the syrup, and stir for 10 minutes. Every day for 4 days draw off 15 or 20 gallons of the mixture and pour it in again; let it rest 4 days more, then add the fining, stir for 10 minutes, and bung up the cask. In 3 or 4 days, if bright, draw off slowly, so as not to disturb the lees. Filter (*see No.* 714), and it is ready for the fountain of the gassing apparatus.

718. To Charge Champagne with Gas. Matthews' apparatus is the one usually adopted in the United States for generating the gas and charging champagne wine. The fountains, tubes, and valves are silver-lined, and the machines are adapted for pint and quart bottles. The following is a proper charge for a No. 2 apparatus with 2 fountains: Charge the generator with 9 gallons water, 6 gallons ground marble, and 3 gallons sulphuric acid; put 2 gallons water in the gas washer, and 20 gallons wine in each of the fountains. For a warm climate, a pressure of 70 pounds to the square inch is sufficient. When the wine is made in winter for immediate sale, the pressure may be increased to 80 pounds. Genuine champagne has an average pressure of 50 pounds.

719. Catawba Champagne. Take 40 gallons Catawba wine; ½ gallon old cognac brandy; and 4 gallons syrup made of 30 pounds sugar and 2 gallons water according to No. 715;—or, 38 gallons Catawba wine; 2 gallons Angelica wine, and 4 gallons syrup as above. A very little tincture vanilla added to either of these makes a fine bouquet.

720. California Champagne. 40 gallons California wine; 1 quart raspberry syrup (*see No.* 1372); 4 gallons syrup made of 25 pounds sugar and 2 gallons water (*see No.* 715); and 4 gallons water. Or: 20 gallons California wine; 20 gallons Sauterne or white Bordeaux wine; ½ gallon old cognac brandy; with 4 gallons syrup as before. Add to these 10 per cent. of water.

721. Scuppernong Champagne. 40 gallons Scuppernong wine; ½ gallon old cognac brandy; and 3 gallons syrup made of 20 pounds sugar (*see No.* 715) and 2 gallons water.

722. Imitation French Champagne. 40 gallons white Bordeaux wine; 1 gallon muscat wine; ½ gallon old cognac brandy; and 4 gallons syrup made of 25 pounds sugar and 2 gallons water. (*See No.* 715). In this receipt a little tincture of vanilla, or a small bottle of bouquet venatique, may be used instead of the muscat wine. They may be omitted altogether if aroma is not desired.

723. Cheap Champagne. 13 gallons California wine; 13 gallons white Bordeaux wine; 13 gallons water; 1 gallon 95 per cent. French spirit; 1 quart raspberry syrup (*see No.* 1372); and 4 gallons syrup made of 25 pounds sugar and 2 gallons water. (*See No.* 715.) Or: 20 gallons Catawba wine; 20 gallons water; 2 gallons Angelica wine; 2 gallons 95 per cent. French spirit, and 4 gallons syrup as before.

724. Cheap Champagne. 20 gallons white Bordeaux wine; 20 gallons German or Hungarian wine; 20 gallons water; 2 gallons 95 per cent. French spirit; and 6 gallons syrup made of 35 pounds sugar and 3 gallons water. (*See No.* 715.)

725. The Use of Glycerine in Wine. Glycerine differs from sugar in not fermenting or taking any active part in the process of fermentation. It can, therefore, be made use of after fermentation, to impart any required degree of sweetness to wine, without the risk of further fermentation, as is the case with sugar when used for this purpose; it is said that it can be added with perfect safety to even a young or new wine, as soon as it has become clear. It is absolutely necessary that the glycerine should be chemically pure; care is consequently to be taken in purchasing it, as there are few articles in the market which are liable to contain so many impurities. (*See No.* 1151.) The proportion of glycerine should be from 1 to 3 gallons for 100 gallons of wine, according to the quality of the latter. If the wine is perfectly clear before adding the glycerine it will be ready for bottling at once. It is best to mix the glycerine first with an equal quantity of the wine, and then add the mixture to the remainder of the wine.

726. Electricity as an Agent for improving Whiskey and Wines. From experiments made on a large scale, it has been found that electricity in any form, either as a regular current or a succession of discharges, renders wine or whiskey mellow and mature. It is supposed that the bitartrate of potassa is decomposed, setting free potash and tartaric acid: the former tending to neutralize the acids of the wine; and the tartaric acid, reacting upon the fatty matters present, favors the formation of the ethers which constitute the bouquet of the wine. It is probable, also, that a small quantity of the water is decomposed, setting free oxygen, which forms, with some of the constituents of the wine, new compounds peculiar to old wines. (*See No.* 6295.)

Home-Made Wines.

The various processes in domestic wine-making resemble those employed for foreign wine, and depend upon the same principles. The fruit should be preferably gathered in fine weather, and not till it has arrived at a proper state of maturity, as evinced by its flavor when tasted; for if it be employed while unripe, the wine will be harsh, disagreeable, and unwholesome, and a larger quantity of sugar and spirit will be required to render it palatable. The common practice of employing unripe gooseberries for the manufacture of wine arises from a total ignorance of the scientific principles of wine-making. On the other hand, if fruit be employed too ripe, the wine is apt to be inferior, and deficient in the flavor of the fruit. The fruit being gathered, it next undergoes the operation of picking, for the purpose of removing the stalks and unripe or damaged portion. It is next placed in a tub, and well bruised. Raisins are commonly permitted to soak about 24 hours previously to bruising them, or they may be advantageously bruised or minced in the dry state. The bruised fruit is then put into a vat or vessel with a guard or strainer placed over the tap-hole, to keep back the husks and seeds of the fruit when the must or juice is drawn off. The water is now added, and the whole macerated for 30 or 40 hours, more or less; during which time it is frequently stirred up with a suitable wooden stirrer. The liquid portion is next drawn off, and the residuary pulp is placed in hair bags and undergoes the operation of pressing, to expel the fluid it contains. The sugar, tartar, &c. (in very fine powder, or in solution), are now added to the mixed liquor, and the whole is well stirred. The temperature being suitable (generally from 75° to 85° Fahr.), the vinous fermentation soon commences, when the liquor is frequently skimmed (if necessary) and well stirred up, and, after 3 or 4 days of this treatment, it is run into casks, which should be quite filled, and left open at the bung-hole. In about a week the flavoring ingredients, in the state of coarse powder, are commonly added, and well stirred in, and in about another week, depending upon the state of the fermentation and the attenuation of the must, the brandy or spirit is added, and the cask filled up, and bunged down close. In 4 or 5 weeks more the cask is again filled up, and, after some weeks—the longer the better—it is "pegged" or "spiled," to ascertain if it be fine or transparent; if so, it undergoes the operation of racking; but if, on the contrary, it still continues muddy, it must previously pass through the process of fining. Its future treatment is similar to that of foreign wine. The must of many of the strong-flavored fruits, as black currants, for instance, is improved by being boiled before being made into wine; but the flavor and bouquet of the more delicate fruits are diminished, if not destroyed, by boiling.

728. General Receipt for the Preparation of Home-Made Wine from Ripe Saccharine Fruits. I. Ripe fruit, 4 pounds; clear soft water, 1 gallon; sugar, 3 pounds; cream of tartar, dissolved in boiling water, 1½ ounces; brandy, 2 to 3 per cent. Flavoring as required. Makes a good family wine. II. As the last, using 1 pound more each of fruit and sugar. A superior wine.

III. As the first, adding 2 pounds each fruit and sugar. Very strong. Is good without brandy, but better with it. 1½ pounds of raisins may be substituted for each pound of sugar above. In the above way may be made the following wines:—gooseberry wine, currant wine (red, white or black); mixed fruit wine (currants and gooseberries; or black, red, and white currants, ripe black-heart cherries, and raspberries, equal parts). This is a good family wine. Cherry wine; Colepress's wine, (from apples and mulberries, equal parts); elder wine; strawberry wine; raspberry wine; mulberry wine (when flavored makes port); whortleberry (sometimes called huckleberry) wine; makes a good factitious port; blackberry wine; morella wine; apricot wine; apple wine; grape wine, &c.

729. General Receipt for Making Wine from Dry Saccharine Fruit. I. Dry fruit, 4½ pounds; soft water, 1 gallon; cream of tartar (dissolved), 1 pound; brandy, 1½ to 2 per cent., weak.

II. As the last, but using 5½ pounds dried fruit. A superior family wine.

III. As the last, 7½ pounds fruit, and brandy 3 per cent. A strong wine. Should the dried fruit employed be at all deficient in saccharine matter, 1 to 3 pounds may be omitted, and half that quantity of sugar, or two thirds of raisins, added. In the above manner may be made raisin wine, fig wine, &c.

730. Imitation Champagne. Stoned raisins, 7 pounds; loaf sugar, 21 pounds; water, 9 gallons; crystallized tartaric acid, 1 ounce; honey, ½ pound; ferment with sweet yeast 1 pound or less; skim frequently, and when the fermentation is nearly over, add coarse-powdered orris root, 1 drachm, and eau de fleurs d'orange, 3 ounces; lemon juice, ¼ pint. Rack it, bung close, and in 3 months fine it down with isinglass, ½ ounce; in 1 month more, if not sparkling, again fine it down, and in 2 weeks bottle it, observing to put a piece of double-refined sugar, the size of a pea, into each bottle. The bottles should be wired, and the corks covered with tin foil.

731. To Make Blackberry Wine. To make 10 gallons of this cheap and excellent wine, press the juice out of sufficient fresh ripe blackberries to make 4½ gallons; wash the pomace in 4½ gallons soft spring water, and thoroughly dissolve in it 6 pounds white sugar to each gallon of water (brown sugar will do for an inferior wine); strain the juice into this syrup, and mix them. Fill a cask with it perfectly full, and lay a cloth loosely over the bung-hole, placing the cask where it will be perfectly undisturbed. In two or three days fermentation will commence, and the impurities run over at the bung. Look at it every day, and if it does not run over, with some of the mixture which you have reserved in another vessel fill it up to the bung. In about three weeks, fermentation will have ceased, and the wine be still; fill it again, drive in the bung tight, nail a tin over it, and let it remain undisturbed until the following March. Then draw it off, without shaking the cask, put it into bottles, cork tightly and seal over. Some persons add spirit to the wine, but instead of doing good, it is only an injury. The more carefully the juice is strained, the better the quality of the sugar, and the more scrupulously clean the utensils and casks, the purer and better will be the wine.

732. Cider Wine. Let the new cider from sour apples (ripe, sound fruit preferred), ferment from 1 to 3 weeks, as the weather is warm or cool. When it has attained to a lively fermentation, add to each gallon, according to its acidity, from ½ to 2 pounds white crushed sugar, and let the whole ferment until it possesses precisely the taste which it is desired should be permanent. In this condition pour out a quart of the cider and add for each gallon ¼ ounce of sulphite (not sulphate) of lime. Stir the powder and cider until intimately mixed, and return the emulsion to the fermenting liquid. Agitate briskly and thoroughly for a few moments, and then let the cider settle. Fermentation will cease at once. When, after a few days, the cider has become clear, draw off carefully, to avoid the sediment, and bottle. If loosely corked for a short time, it will become a sparkling cider wine, and may be kept indefinitely long.

733. Honey or Mead Wine. Honey, 20 pounds; cider, 12 gallons; ferment, then add rum, ½ gallon; brandy, ½ gallon; red or white tartar (dissolved), 6 ounces; bitter almonds and cloves, of each ¼ ounce. The process of fermenting, clearing and bottling, is similar to the last receipt.

734. Specimen Process to Make Unripe Grape, Currant, Gooseberry and Rhubarb Wine, according to the process of Dr. McCulloch. Gather the fruit when it is nearly full grown, but before it shows the least sign of ripening. Any kind will do, but it is advisable to avoid choosing those which, when ripe, would be highly flavored. All unsound and bruised fruit should be rejected, and the stalks and remains of blossom removed by picking or rubbing. The following receipt is one of the best on the subject: 40 pounds fruit are to be bruised in small quantities, in a tub which will hold 15 or 20 gallons, sufficient pressure only being used to burst the berries, without breaking the seeds or much compressing the skins. 4 gallons water are then to be poured on the fruit, which is to be carefully stirred, and squeezed with the hands until the whole of the juice and pulp are separated from the solid matter. It is then to rest for a few hours, when it must be pressed and strained through a coarse canvas bag with considerable force. 1 gallon water may afterwards be passed through the residue, to remove any soluble matter that may be left, and then added to the juice. 30 pounds loaf sugar are now to be dissolved in the juice, and the total quantity of liquid made up with water to 10½ gallons. The liquor is now to be put into a tub, over which spread a blanket, covered by a board, and place in a temperature of from 55° to 60° Fahr. for from 24 to 48 hours, according to the signs which it may show of fermentation, when it is to be put into a cask to ferment. The cask must be of such size that the liquor will nearly reach to the bung-hole, so that the scum may run out as it rises. As the fermentation goes on the liquor will decrease, and the cask must be kept filled up nearly to the bung-hole with a portion of the "must" which has been reserved for that purpose. When the fermentation has become a little weaker, which may be known by the hissing noise decreasing, the bung is to be driven in, and a wooden peg, called a spile, made of tough wood, put into a hole bored in the top of the barrel. After a few days this peg is to be loosened to let out any carbonic acid gas which has been generated. This must be done from time to time, and when there is no further sign of gas generating to the danger of the barrel, the spile may be made tight. The wine should be kept during the winter in a cool cellar, and, if fine, may be bottled on a clear cold day at the end of February or the beginning of March, without further trouble. But to ensure its fineness it is preferable to draw it off at the end of December into a fresh cask, so as to clear it from the lees. At this time, also, if it is found to be too sweet for the maker's taste, he should stir up the lees so as to renew the fermentation, at the same time raising the temperature. When it is transferred to the fresh cask, it should be fined with isinglass. Sometimes it is desirable to rack it off a second time into a fresh cask, again fining it. All these removals should be made in clear, dry, and if possible, cold weather. It must be bottled in March. This wine will usually be brisk, but circumstances will occasionally cause it to be sweet and still, and sometimes dry. If sweet, it may be re-made the following season, by adding to it juice from fresh fruit, according to the degree of sweetness, and fermenting and treating it as before. But if it be dry, briskness can never be restored, and it must be treated as a dry wine, by drawing it off into a cask previously fumigated with sulphur (*see No.* 766), and fining and bottling it in the usual manner. Such dry wines sometimes taste disagreeably in the first and second year, but improve much with age. If the whole marc or husks, etc., is allowed to remain in the juice during the first fermentation, the process will be more rapid, and the wine stronger and less sweet; but it will have more flavor. If the wine is desired to be very sweet as well as brisk, 40 pounds of sugar may be used; less sweet and less strong, 25 pounds; it will be brisk, but not so strong, and ought to be used within a year.

735. Ripe Gooseberry Wine. Put the ripe and well picked red gooseberries into a tub or pan, bruise the fruit well, and leave it uncovered for 24 hours. Squeeze the juice from the pulp through a hair or canvas bag. Put the residue of each squeezing into a vessel; pour upon it ½ gallon of boiling water for each gallon of fruit used, and stir well for a quarter of an hour. Let it stand for 12 hours, squeeze the pulp through the bag, and add the liquor to the juice of the fruit obtained. Add 2½ pounds sugar to each gallon of the liquor, and stir it well. Let it stand to ferment. When it has done fermenting, draw it off and add ¾ pint brandy to each gallon. Let it stand to settle for 4 or 5 weeks, then draw it off carefully into a cask that will just hold it; keep it in a cool cellar for twelve months or more, when it may be bottled. Choose a clear, dry, cold day. It ought to be a splendid wine in 2 years.

736. Ginger Wine. Boil 20 pounds sugar in 7 gallons water for half an hour, skimming it well; then put 9 ounces bruised ginger in a portion of the liquor, and mix all together. When nearly cold, put 9 pounds raisins, chopped very small, into a nine-gallon cask, add 4 lemons sliced, after taking out the seeds, and pour the liquor over all, with ½ pint yeast. Leave the cask open for 3 weeks, keeping it filled up with some of the reserved liquor, and bottle it in from 6 to 9 months.

737. Ginger Wine. Another Process. Boil 26 pounds raw sugar in 7 gallons water for half an hour, skimming it well; then, if the syrup is quite clear from scum, pour it boiling upon 8 ounces bruised ginger and 16 lemons sliced; when the whole has cooled down to about 75°, squeeze out the lemons and ginger through a sieve, and add the yeast. Let it work for about 3 days, and then draw it off into a cask. Put half of the lemon and ginger residue in with it. Some first pare the lemons, and having rubbed the rinds with loaf sugar, add the latter when it is done working. Bottle in 3 months.

738. To Make Aromatic Ginger Wine. Reduce the following to coarse powder: 5 pounds Jamaica ginger root, 6 to 8 ounces cloves, 1 pound allspice, ½ pound cinnamon, and ½ pound mace. Infuse these for 10 days in 10 gallons 95 per cent. spirit, stirring every day, and then filter. Then dissolve 50 pounds white sugar in 85 gallons water; mix the whole together, and color with cherry juice; then filter.

739. To Make Ten Gallons of Ginger Wine. Boil ¾ pound best white Jamaica ginger, bruised, in about 8 gallons water; add the whites of 6 eggs to ¼ ounce isinglass, 15 pounds loaf sugar, and the rinds of 6 lemons; boil the compound ¾ of an hour, and skim it clean; when nearly cold put it into a vessel that will admit of its being drawn off; set it to work with yeast, and in a few days afterwards draw it off into a cask; then add the juice of the 6 lemons, and 2 quarts spirits; in a week or ten days bung the cask closely, and when thoroughly fine, bottle the wine off. It will be fit to drink in 4 months.

740. Simple Receipt for Making Grape Wine. Put 20 pounds of ripe, fresh-picked, and well selected grapes into a stone jar, and pour on them 6 quarts boiling water; when the water has cooled enough, squeeze the grapes well with the hand; cover the jar with a cloth, and let it stand for 3 days; then press out the juice, and add 10 pounds crushed sugar. After it has stood for a week, scum, strain, and bottle it, corking loosely. When the fermentation is complete, strain it again and bottle it, corking tightly. Lay the bottles on their side in a cool place.

741. Fine Grape Wine. In order to make good wine it is necessary to have a good cellar, clean casks, press, etc. First of all, have your grapes well ripened; gather them in dry weather, and pick out carefully all the unripe berries, and all the dried and damaged ones; then mash them; or, if you have a proper mill for the purpose, grind them. Be careful not to set the mill so close as to mash the seed, for they will give a bad taste to the wine. If you wish to have wine of a rose color, let the grapes remain in a large tub a few hours before pressing. The longer time you leave the grapes before pressing, after they are mashed, the more color the wine will have. For pressing the grapes, any press will answer, provided it is kept clean and sweet. After you have collected the must in a clean tub from the press, transfer it into a cask in the cellar. Fill the cask within 10 inches of the bung; then place one end of a syphon, made for that purpose, in the bung, and fix it air-tight; the other end must be submerged fully 4 inches in a bucket of cold water. The gas thus passes off from the cask, but the air is prevented from coming in contact with the wine, which would destroy that fine grape flavor which makes Catawba wine so celebrated. When properly made, the must will undergo fermentation. When it has fermented, which will be in 15 days, fill the cask with the same kind of wine and bung it loosely for 1 week; then make it tight. Nothing more is needed till it is clear, which, if all is right, will be in the January or February following. Then, if perfectly clear, rack it off into another clean cask, and bung it up tightly until wanted. If the wine remains in the cask till about November, it will improve by racking it again. Be sure to have sweet, clean casks. Do not burn too much brimstone in the cask. (*see No.* 766); much wine is injured by excessive use of brimstone—a mistake generally made by new beginners. Different qualities of wine can be made with the same grape by separating the different runs of the same pressing. The first run is the finest to make use of the first season; but it will not keep long without losing its fine qualities. To make good sound wine, that will improve by age, the plan is to mix all up together. The very last run will make it rough, but it will have better body and better flavor when 2 or 3 years old, and will improve for a number of years. The first run will not be good after 2 or 3 years.

742. To Fine Wine Difficult to Clarify, or Thick in Consequence of an Imperfect Fermentation. To clarify 60 gallons, take 1 ounce of the species of Dock or Rumex plant, called Patience root, which boil in 1 quart water. When cold, filter, and add 1 ounce common salt, then 1 glass sheep's blood. Beat all the ingredients well together with a broom until the mixture foams up well, then add it gradually to the wine, stirring continually while pouring it in, and for 15 minutes afterwards. In a few days the wine will be clear.

743. To Fine Madeira or any kind of Wine with Isinglass. To fine 40 gallons wine, steep 1 ounce isinglass in 1 pint of pure cold water over night, and then melt it over a gentle charcoal fire, until a uniform gelatinous mass is formed. When cool, mix with it 3 pints wine, and let it repose 12 hours in a moderately warm room. Then add 1 gallon wine and mix the whole in a wooden vessel; whisk it with a clean broom until it foams up. Pour this mixture gradually in the wine you desire to fine, being careful to stir the whole continually during the process. Bung up the cask, and in the course of 48 hours the wine will appear perfectly clear and bright. Isinglass prepared in this way will precipitate perfectly, and leave no particles suspended in the wine.

744. To Fine White Wine with Eggs. To fine 60 gallons white wine, take the whites of 5 or 6 fresh eggs, 1 egg-shell nearly reduced to powder, and a small handful of common salt. Beat the whole together in a little of the wine, with a small clean broom, until it foams, then pour it into the wine gradually, constantly stirring it all the while.

745. To Fine Red Wine. This is clarified in the same way. When you have Roussillon, or the dark wines called vin du midi, which are usually of a deep color, and wish to make it of a lighter color, add 5 or 6 eggs, yellows, whites, and shells together, with a small handful of salt.

746. To Fine a Pipe of Port Wine. Take the whites and shells of ten good eggs, and beat them up to a froth in a wooden bucket; add 1 gallon of Port and whisk it well up to a froth with a clean broom; draw off 4 gallons, and put the finings in it; stir it up well, leaving out the bung one day; then bung it up, and in ten days it will be fit to bottle. If the weather be warm, mix up 1 pint silver sand and add to the finings.

747. To Fine Wine, Cider, Ale, or Porter. Take 1 pound finely shredded isinglass, and macerate it in wine, sour beer, cider, or vinegar; add more of the liquid as the isinglass swells, until about a gallon has been used, agitation with a whisk being occasionally had recourse to, for the purpose of promoting the solution. As soon as the whole of the isinglass is dissolved, the mixture is reduced to the consistence of thin syrup, with wine or the liquid that the finings are intended for. The whole is next strained through a cloth or hair sieve, and at once reduced to a proper state of dilution, by the addition of more liquor. A pound of good isinglass will make 10 to 12 gallons of finings. 1 to 1½ pints is the usual quantity for a barrel of ale or porter; and 1 quart for a hogshead of wine or cider.

748. To Decolor Wine. The color of wine is subject to change; naturally it is precipitated by age and exposure to the light; artificially it is removed by the action of lime-water, skimmed milk, milk of lime, and sometimes fresh-burnt charcoal. Wines that have acquired a brown color from the cask, or red wines that have become "pricked" (*see No.* 752), or dark wines of any kind, may easily be turned into white wine by employing either of the above substances. In this way brown Sherry is commonly changed to pale Sherry; for this purpose 2 or 3 pints of skimmed milk are generally sufficient to decolor a cask of wine; but when it is found necessary to change the color of red wine, 2 or 3 quarts or more will be required. Charcoal is not often used, as it affects the flavor as well as color of wine. A little milk of lime may sometimes be substituted for milk, especially when the wine to be decolored is very acid, and red wines may be rendered quite colorless by it.

749. To Remedy Ropiness in Wine. The peculiar cloudy, stringy, oily appearance in wine, called by the French "graisse," and by the Americans "ropiness," is occasioned by the presence of a glutinous substance, and is generally observed in those white wines which do not contain much tannin. M. Francois, a chemist, first discovered the cause, and pointed out the proper remedy, in the addition of tannin. He recommended the use of 1 pound of the bruised berries of the mountain ash in a somewhat unripe state, well stirred in each barrel of the wine to be improved. After agitation, the wine is to be left to repose a day or two, and then racked off. The tannin in the berries by this time will have separated and precipitated the glutinous matter from the liquid, and removed the ropiness. Wines thus affected cannot be fined in the regular way, as they do not contain sufficient of the astringent principle to cause the coagulation or precipitation of the finings; this principle must therefore be supplied, and for pale white wines, which are the kind chiefly attacked with ropiness, nothing equals a little pure tannin or tannic acid dissolved in proof spirit. Red wines contain so much tannic acid that they are never troubled by ropiness. Wine, after having been cured of ropiness, should immediately be fined and bottled.

750. To Ripen Wine. Dealers adopt various ways to hasten the ripening of wine. One of the safest and best plans for this purpose, especially for strong wines, is to let them remain on the lees 15 to 18 months before racking off, or, whether "crude" or "racked," keeping them at a temperature ranging between 50° to 60° Fah., in a cellar free from draughts, and not too dry. Dealers sometimes remove the bungs or corks, and substitute bladders fastened air-tight. Bottled wine treated in this way, and kept at about 70° Fah., ripens very rapidly. 4 or 5 drops of acetic acid added to a bottle of some kinds of new wine, immediately gives it the appearance of being 2 or 3 years old.

751. To Remedy Sour Wine. The souring of wine is produced by various circumstances, sometimes from its having been kept in a warm cellar where it has been exposed to draughts of air, often by the vibration occasioned by the rolling of heavy bodies over the cellar; but most frequently it originates from the wine having been imperfectly fermented. The only safe remedy for the souring of wine is the cautious addition of a little neutral tartrate of potash; it may also be mixed with a larger quantity of rich wine of its kind, at the same time adding a little good brandy. Wine treated in this way should be fined after having stood 2 or 3 weeks, and then immediately bottled, and consumed as soon as possible, for it will never prove a good keeping wine. (*See No.* 761.)

752. To Restore Pricked or Decaying Wine. If the wine is only thick, add 2 pints of milk to every 30 gallons of wine, and stir 10 minutes. But if the wine has an inferior taste, or is partly or entirely spoiled, treat it as follows: Put the 30 gallons wine into a clean cask, then take 2 pints spirit of wine, 95 per cent.; 3 ounces common salt; 1 pound white sugar. Dissolve the salt and sugar in ½ gallon of the wine, and add the spirit. Then pour the whole gradually into the wine, being careful to stir it continually with a stick during the operation. After the mixture is all poured in the wine, stir the whole for 10 minutes longer. Then add 2 pints milk and continue stirring 10 minutes more. After some days the wine will be completely clarified and restored. "Pricked" wine signifies wine which has been slightly soured.

753. To Remedy Excessive Acidity in German Wine. Simply add a little chalk. This mode of correcting the sourness of wine is perfectly harmless, whereas the pernicious practice of using white and vitrified lead for this purpose cannot be too much condemned. Lead in any form is a poison.

754. To Restore Sour Wine with Potash. To 25 gallons wine, add 4 ounces potash dissolved in a little water, and stir well with a stick for 10 minutes.

755. To Test Wines Beginning to Decompose. Many persons are unaware of the difference between a wine that is beginning to decompose (called in French the Poux), and that in which the acetous fermentation has commenced. The Poux appears at the bottom of the barrel, while acetification begins at the top. For the first stage of the Poux the wine becomes thick, and has a peculiar taste termed flat. For the second stage the wine becomes still more troubled, and has the taste of stagnant water. Finally, in the last stage, when the decomposition has reached its maximum, the wine becomes grayish and appears like muddy water. If some of the wine is put into a champagne glass and a pinch of tartaric acid is added, a red color will be produced, which will not be the case if the wine is in a state of acetous fermentation.

756. Remedy for Decomposition in Wines. As soon as discovered add tartaric acid in the proportion of 1¾ ounces to every 20 gallons of the wine, and let it rest for a few days, when, if the wine has not regained its natural color, a little more tartaric acid must be added.

757. Sweating In and Fretting In Wine. The technical terms "sweating in" and "fretting in" are applied to the partial production of a second fermentation, for the purpose of mellowing down the flavor of foreign ingredients (chiefly brandy) added to wine. For this purpose 4 or 5 pounds sugar or honey, with a little crude tartar (dissolved), are commonly added per hogshead; and when the wine is wanted in haste, 1 or 2 spoonfuls of yeast, or a few bruised vine leaves are also mixed in, the cask being placed in a moderately warm situation until the new fermentation is established, when it is removed to the wine-cellar, and, after a few days, fined down.

758. To Remove Mustiness from Wine. The disagreeable taste in wine, generally known as mustiness, is occasioned by the presence of an essential oil. This may be removed by adding a little sweet or almond oil, and then violently stirring the wine for some time. The fixed oil attracts and seizes on the essential oil, and rises with it to the surface, when it is easily skimmed off, or the liquid under it drawn off. A few slices of burnt or toasted bread, or a little bruised mustard seed or coarsely powdered charcoal, will often have the same effect.

759. Pasteur's Method of Preserving Wines. M. Pasteur announced some time ago that wines became spoiled in consequence of the presence of microscopic organisms, which could be destroyed by exposing the wine, for a few moments only, to a temperature of 131° Fahr. A committee of experts was appointed to make a comparative examination of wines which had and which had not been subjected to heat; M. Lapparent being President, and M. Dumas and M. Pasteur assisting. They concluded that the preservation of wine in bottles is greatly improved by heating; that the destruction of the germs is perfect, without the least impairment of the taste, color, or limpidity of the wines.

760. To Determine the Nature of Acidity in Wine. If wine has undergone the acetous fermentation, then convert it at once into vinegar by one of the usual modes. But if its acidity proceeds from an excess of tartaric acid, this defect may be remedied by shaking the wine with a concentrated solution of neutral tartrate of potassa, which, with the surplus of tartaric acid, will form bitartrate of potassa, and precipitate as such. To discover the nature of the acidity, neutralize an ounce or so of the wine with some carbonate of soda, then add a small quantity of sulphuric acid, and boil up; if acetic acid or vinegar be present, it will be perceptible by its odor. (*See No.* 751.)

761. Parent's Method of Preserving Wine. This consists in the addition of a small quantity of tannin or tannic acid to the wine, which perhaps acts in a similar way, by destroying the vitality of the spores of the fungus, since a microscopic examination of wine known to contain these germs, within a few weeks after being treated with the tannin, has failed to detect the slightest trace. Indeed, wine which has already begun to change, and become turbid, can be restored to its primitive clearness, and with a great improvement in its taste. Care must be taken, however, to use only tannin which has been prepared from the constituents of the grape, since the slightest proportion of the extract of nut-gall, although accomplishing the general object of destroying the fungus, will impart a peculiar taste, which never disappears.

762. Antiferments. Substances used in small quantities for arresting fermentation in cider, wine, and malt liquors. The following formulæ are effective, and have the advantage of being harmless. (*See No.* 835.)

763. Antiferments for Cider. Sulphite (not sulphate) of lime in fine powder, and as newly prepared as possible. Or, 2 parts sulphite of lime and 3 parts ground black mustard seed.

764. Antiferments for Cider, Wine, Malt Liquors, &c. Grind or bruise together 13 pounds new mustard seed and 1 pound cloves. This mixture may be used with or without the addition of 10 ounces ground capsicum.

765. To Induce Fermentation. If fermentation does not begin within a reasonable time, raise the temperature by covering the vessel with blankets, and moving it near to a fire. Or, warm a portion of the must and add it to the rest. A small quantity of yeast, previously well mixed with some of the liquor, gently stirred in, will have the same effect. Or, the must may be warmed by placing large stone bottles, filled with boiling water and well corked, in the liquor.

766. To Arrest Fermentation. Dip a strip of linen or cotton, an inch wide and seven inches long, into melted sulphur. Fasten a wire into the bung of a 60-gallon cask, so that the end will hang about the middle of the inside of the cask, bend the end up to form a hook, place the sulphur tape on the hook, ignite it, and insert it in the cask, bunging loosely. In about an hour the cask will be impregnated with sulphurous acid; then withdraw the match, and fill up with wine, and bung up tight. This will stop further fermentation. This is a good plan for white wines, but not for red wines, as sulphur injures their color. Sulphite (not sulphate) of lime is also sometimes employed to arrest fermentation. (*See No.* 835.)

Cordials or Liqueurs.

The materials employed in the preparation of cordials are rain or distilled water, white sugar, and clean, perfectly flavorless spirit. To these may be added the substances from which the flavor and aroma are extracted, which distinguish and give character to the particular cordial to be made, and also the articles employed as "finings" when artificial clarification is had recourse to. In the preparation or compounding of cordials, one of the first objects which engages the operator's attention is the production of an alcoholic solution of the aromatic principles which are to give them their peculiar aroma and flavor. (*See No.* 812.) This is done either by simple infusion or maceration, or by maceration and subsequent distillation, or by flavoring the spirit with essential oils. In the preparation of liqueurs, glycerine has been found to be admirably adapted for preserving the characteristic flavors of those compounds, and it has consequently become the great favorite of this class of manufactures. (*See No.* 725.)

768. Cordials Made by Maceration, or with Essential Oils. When essential oils are employed to convey the flavor, they are first dissolved in a little of the strongest rectified spirit of wine, and when added to the spirit they are mixed up with the whole mass as rapidly and as perfectly as possible by laborious and long continued agitation. The stronger spirit may be reduced to the desired strength by means of clear soft water, or the clarified syrup used for sweetening. The sugar employed should be of the finest quality, and is preferably made into syrup before adding it to the aromatized spirit; and this should not be added until the latter has been rendered perfectly fine by filtering or fining. Some spirits, as anise seed, etc., frequently require this treatment, which is best performed by running them through a fine and clean filter, having previously mixed them with a spoonful or two of magnesia. By good management, cordials thus made will be perfectly clear and transparent; but should this not be the case, they may be fined with the whites of about 12 or 20 eggs to the hogshead, or by adding a little alum, either alone or followed by a little carbonate of soda or potassa, both dissolved in water. In a week or a fortnight the liquor will be clear.

769. To Make Doppelt Kummel or Caraway. Dissolve separately, each in a little 95 per cent. alcohol, ½ drachm oil of anise, and 5 drops each of the oils of calamus, bitter almonds, and coriander; dissolve also 1 to 1½ ounces oil of caraway in sufficient alcohol (95 per cent.) to make a clear solution. Incorporate these with 40 gallons French proof spirit; and add 10 pounds sugar dissolved in 5 gallons water.

770. To Make Anisette. To 30 gallons French proof spirit add 4 ounces essence of star anise dissolved in 95 per cent. alcohol, and 105 gallons syrup of 10° Baumé. Stir for ½ an hour, settle and filter.

771. To Make Curaçoa. Slice the outside peel very thin from 60 bitter oranges; infuse for 15 days with 4 drachms bruised cinnamon, and 2 drachms bruised mace, in 5 gallons 95 per cent. French spirit, stirring every day. Then add 25 pounds white sugar dissolved in 2 gallons water; color with caramel (*see No.* 694); stir thoroughly, and filter.

772. To Make Maraschino. Dissolve in 1½ gallons 95 per cent. alcohol, 1½ ounces essence of maraschino, 1½ drachms essence of rose, ½ drachm essence of noyau, 5 drops essence of cloves, and 8 drops essence of cinnamon; add ½ gallon orris root flavoring. (*See No.* 669.) Mix the above with 12 gallons 95 per cent. alcohol and 26 gallons syrup of 30° Baumé. Stir thoroughly and filter.

773. Superfine Maraschino. 4 ounces essence of noyau; 1 ounce essence of rose; ½ ounce essence of neroli (genuine); 4 drachms of mace, infused in 95 per cent. alcohol; ¼ pound cinnamon, infused in 1 quart of water; 2 ounces cloves, infused in 1 pint of water; 2 pounds orris root (powdered), infused in 2 gallons 95 per cent. alcohol for 15 days. Dissolve the essences in 2 gallons 95 per cent. alcohol. Mix, put into a barrel 41 gallons 85 per cent. alcohol; add the aromas, in 4 gallons 95 per cent. alcohol; sugar syrup, 90 gallons 32° Baumé. Stir all the ingredients well together for at least half an hour, and let the mixture stand two weeks; then filter and put in the filter two or three sheets of filtering paper. (*See No.* 811.)

774. Maraschino. 1¼ ounces essence of maraschino, 1½ drachms essence of rose, ½ drachm essence of noyau, 8 drops essence of cinnamon, 5 drops essence of cloves, ½ pound orris root (powdered), infused in ½ gallon 95 per cent. alcohol for 15 days. Dissolve the essences in 1 gallon 95 per cent. alcohol. Mix, put in a barrel 12 gallons 80 per cent. alcohol and add 2 gallons 95 per cent. perfumed alcohol (as described above); sugar syrup, 26 gallons 25° Baumé's saccharometer. Mix and filter as directed in the last receipt.

775. Maraschino, 3½ ounces essence of noyau, 6 drachms essence of rose. Dissolve the above in ½ gallon 95 per cent. alcohol, and add 4 spoonfuls of magnesia, 1 gallon orange flower water, ½ pound cinnamon (bruised) infused in ½ gallon water, ¼ pound cloves (bruised), infused in ¼ gallon of water, 4 drachms mace infused in alcohol, 2 pounds orris root (powdered) infused in 2 gallons 95 per cent. alcohol for 15 days. Mix 41 gallons 80 per cent. alcohol, 90 gallons syrup 25 degrees Baumé, and add 4 gallons perfumed spirits, as described above. Stir and filter as already directed.

776. Curaçoa d'Hollande. 2 pounds Curaçoa orange peel, ½ pound Ceylon cinnamon. Let them soak in water; boil them for 5 minutes with the juice of 32 oranges and 14 gallons of white plain syrup; then add 6 gallons of 95 per cent. alcohol; strain, filter; color dark yellow with sugar coloring. This receipt will make a splendid curaçoa.

777. Curaçao. 2 ounces each essence of bitter oranges and neroli; ¼ ounce essence of cinnamon; 3 drachms mace infused in alcohol. Dissolve the above essences in 1 gallon 95 per cent. alcohol, then put in a clean barrel 13 gallons 85 per cent. alcohol, 26 gallons sugar syrup 30 degrees Baumé, and add 1 gallon perfumed spirit, as above. Color with saffron or turmeric.

778. Champion Anisette. Put into a barrel 30 gallons 85 per cent. alcohol. Add 4 ounces essence of anise seed, which dissolve in 2 gallons 95 per cent. alcohol. Add 103 gallons sugar syrup 10° Baumé. Stir 15 minutes and let it rest 4 or 5 days, then filter. Add 2 or 3 sheets of filtering paper. (*See No.* 811.)

779. Anisette. Put in a barrel 13 gallons 95 per cent. alcohol. Dissolve 3½ ounces essence of green anise seed in 1 gallon 95 per cent. alcohol, and add ½ gallon orange flower water, 8 or 10 drops infusion of mace, and 5 drops essence of cinnamon. Then put in the barrel 26 gallons sugar syrup 25° Baumé. Stir and filter as directed in the last receipt.

780. Anise Seed Cordial. Dissolve 3 drachms of oil of anise seed in 2¾ gallons of 95 per cent. alcohol; then add 2½ gallons of fine white syrup, mixed with 4¾ gallons of water. Stir and filter.

781. Malliorca d'Espagne. 40 gallons 55 per cent. alcohol, 5 ounces essence green anise seed and 5 ounces essence of star seed dissolved in 95 per cent. alcohol, ½ drachm ether (to give the cordial age). Stir and filter.

782. Blackberry Brandy. To 10 gallons blackberry juice, and 25 gallons spirits 40 above proof, add 1 drachm each of oil of cloves and oil of cinnamon dissolved in 95 per cent. alcohol, and 12 pounds white sugar dissolved in 6 gallons water. Dissolve the oils separately in ½ pint 95 per cent. alcohol; mix both together, and use one half the quantity; if the cordial is not sufficiently flavored, use the balance.

783. Blackberry Brandy. ¼ ounce each of cinnamon, cloves, and mace, 1 drachm cardamom. Grind to a coarse powder; add to 16 pounds of blackberries, mashed, and 5 gallons of 95 per cent. alcohol. Macerate for two weeks; press it; then add 10 pounds of sugar, dissolved in 3⅜ gallons of water. Filter.

784. Cherry Brandy. Mash 16 pounds of black cherries with their stones; 5 gallons 95 per cent. alcohol. Macerate for two weeks; press it; then add 10 pounds of sugar, dissolved in 3⅜ gallons of water. Filter.

785. Peach Brandy. Mash 18 pounds of peaches, with their stones; macerate them for 24 hours with 4¾ gallons of 95 per cent. alcohol and 4 gallons water. Strain, press, and filter; add 5 pints white plain syrup. Color dark yellow with burnt sugar coloring.

786. Imperial Peach Brandy. Take 4½ ounces powdered bitter almonds, 3¼ gallons of 95 per cent. alcohol, 5¼ gallons of water. Mix together, and macerate for 24 hours; then add a strained syrup, made of 3¾ pounds of sugar, 1 pint of peach jelly, 2¼ ounces preserved ginger, 1 lemon cut in slices, 1 drachm of grated nutmegs, 1 drachm of allspice in powder, and 5 pints of water boiled for 2 minutes. Mix the whole, and filter.

787. Peppermint Brandy. To 40 gallons proof spirit add 4 ounces essence of peppermint, dissolved in 95 per cent. alcohol. Color with ½ pound powder of turmeric infused in 1 gallon spirit 95 per cent. Use this infusion in such quantity as to get the proper shade.

788. Kirschenwasser. 100 gallons proof alcohol, 5 ounces essence of noyau, 2 drachms essence of rose. Dissolve the latter ingredient in some 95 per cent. alcohol and add a spoonful of magnesia, 2 pounds orris root (powdered), infused 15 days in 2 gallons 95 per cent. alcohol, 1½ gallons sugar syrup. Stir, and filter if necessary.

789. Caraway Cordial. Dissolve 6 drachms oil of caraway in 3 gallons 95 per cent. alcohol; add a syrup made of 42 pounds of sugar and 4¾ gallons of water. Filter.

790. Ratafia. This word is derived from the Latin pax ratafiat (let peace be ratified). The Latins used to drink ratafia on signing their treaties of peace. Ratafia may be made with the juice of any fruit. Take 3 gallons cherry juice, 4 pounds sugar, dissolved in the cherry juice. Steep in 2½ gallons brandy 10 days 2 drachms cinnamon, 24 cloves, 16 ounces peach leaves, 8 ounces bruised cherry kernels. Filter; mix both liquors, and filter again.

791. To Prepare Cherry Juice by Infusion for making Cherry Bounce and Brandy. Put the cherries into barrels and cover them with 95 per cent. spirit; let them steep for 1 month, and stir them well every 8 days. Use the juice that runs off first, and repeat this operation 2 or 3 times. The last time, you may bruise the cherries and stones, and steep them all together to make cherry brandy.

792. To Prepare Cherry Juice for Boiling. Put the cherries in a kettle tinned inside, cover them with water, and boil them at a gentle heat for 1 hour. When cold put them into barrels and add 1 gallon 95 per cent. spirit to each 10 gallons of the juice.

793. To Make Cherry Bounce (Superfine). To 15 gallons cherry juice, add 15 gallons 80 per cent. spirit; 30 gallons Catalonia or Marseilles wine; 1½ ounces essence of noyau; 3 ounces mace infused in 1 quart 95 per cent. alcohol; ½ pound cinnamon infused in ½ gallon water; ¼ pound cloves ground and infused in 1 quart of water. Put all the above ingredients in a clean barrel and add 60 gallons sugar syrup 25° Baumé. Stir up the ingredients well, and filter after 4 or 5 days. If the color is not deep enough add a little sugar coloring. The above receipt is to make 120 gallons, but a much smaller quantity may be made by reducing the quantity of each ingredient and observing the same proportion in all.

794. To make Cherry Bounce (Second Quality). To 12 gallons cherry juice, add 30 gallons 80 per cent. spirit; 30 gallons Catalonia or Marseilles wine; 3 ounces essence of noyau; ½ pound cinnamon ground and infused in ½ gallon water; ½ pound cloves ground and infused in ½ gallon water; 1½ ounce mace infused in 1 pint 95 per cent. alcohol. Mix all the above ingredients in a clean barrel, and add 60 gallons sugar syrup 13° Baumé. Stir up all the ingredients well together, and filter after 4 or 5 days. Make the color a little darker with sugar coloring (*see No.* 694), and to give a good shade add a little archil.

795. To Make Guignolet, or French Cherry Bounce. To 20 gallons cherry juice add 7½ gallons 95 per cent. spirit; 7½ gallons Catalonia or Marseilles wine; ¾ ounce powdered orris root (infused in 1½ gallons 95 per cent. alcohol); ½ gallon cinnamon water (made as in last receipt); ¼ gallon clove water (made as in last receipt); 1½ ounces mace infused in 95 per cent. alcohol. Mix all the above ingredients in a clean barrel, and add 68 gallons sugar syrup 25° Baumé. Stir up the mixture and let it rest 8 days; then strain.

796. Cordials by Distillation. The solid ingredients should be coarsely pounded or bruised before digestion in the spirit, and this should be done immediately before putting them into the cask or vat; as, after they are bruised, they rapidly lose their aromatic properties by exposure to the air. The practice of drying the ingredients before pounding them, adopted by some workmen for the mere sake of lessening the labor, cannot be too much avoided, as the least exposure to heat tends to lessen their aromatic properties, which are very volatile. The length of time the ingredients should be digested in the spirit should never be less than 3 or 4 days, but a longer period is preferable when distillation is not employed. In either case the time allowed for digestion may be advantageously extended to 10 or 15 days, and frequent agitation should be had recourse to. In managing the still, the fire should be proportioned to the ponderosity of the oil or flavoring, and the receiver should be changed before the faints come over, as the latter are unfit to be mixed with the cordial. The stronger spirit may be reduced to the desired strength by means of clear soft water, or the clarified syrup used for sweetening.

797. To Make Absinthe by Distillation. Put the following ingredients into a cask:—1½ pounds large absinthe, 2 pounds small absinthe, 2½ pounds long fennel, 2½ pounds star anise (breaking the star only), 2½ pounds green anise seed, 6 ounces coriander seed, and 1 pound hyssop; moisten the whole with a little water, allowing it time to soften and swell; then add 12 gallons 95 per cent. alcohol, and steep for 2 or 3 days; next add 10 gallons water, and let the whole steep for 1 day more. The water will reduce the alcohol to about 23 gallons of proof spirit. Distill it, and it will produce nearly 15 gallons absinthe of 65 to 70 per cent. strength. Change the receiver as soon as the spirit, as it comes from the worm, begins to assume a reddish tinge. Color the distilled product, by steeping in it for 10 or 15 days ½ pound mint leaves, ¼ pound melissa leaves, ½ pound small absinthe, 2 ounces citron peel, and ½ pound bruised liquorice root. Strain and filter.

798. Absinthe by Distillation. This is made in the same manner as in the former receipt, with the following ingredients:—40 gallons 75 per cent. spirits, 20 pounds fennel, 20 pounds green anise, 16 pounds large absinthe, 1 pound coriander, and 20 gallons water. This is colored, after distillation, by adding 4 pounds small absinthe, and heating it again until as hot as the hand can bear; then extinguish the fire, let it cool, settle, and filter it.

799. Superfine Curaçoa. Charge of the still: 35 pounds green orange peel, or 50 pounds yellow; 25 gallons 95 per cent. alcohol; add 4 gallons water, making in all 29 gallons, at 90 per cent. Digest for 10 days, and stir daily. In making the above, the following directions must be carefully observed:—I. Distill very carefully. II. When you have drawn off 20 gallons, add 10 gallons water, to draw off the faints, which may be distilled again in the next distillation. III. To make superfine Curaçoa, distill over again in a water-bath, adding 5 gallons water. IV. To know when the faints are coming off, take a little in a glass as it flows, and add ¾ water, as if for absinthe. When it no longer turns milky, the faints are coming off; reserve them for the next distillation. Reduce the Curaçoa above distilled to 82 per cent. Trallé's, which will give 26 gallons. Add 12 gallons 82 per cent. spirit, 7 gallons coloring (as given below), 90 gallons syrup 31° Baumé.

800. Coloring for Curaçoa. 3½ pounds Brazil wood; 1¾ pounds each Campeachy and yellow wood, 7 gallons 90 per cent. alcohol. Mix the above and heat in a water-bath, putting on the head. When the head begins to get hot, rake out the fire and let the whole cool together in the bath.

801. Superfine Maraschino. Charge of the still with water-bath: Take 70 pounds peach or apricot stones, wash with tepid water, and put them into a barrel, making a square hole 4 or 5 inches, in the head, for that purpose. Cover them with 35 gallons 95 per cent. alcohol, and let them steep for one month. Then distill the whole.

Note the following observations.—I. Before distilling, add 4 pounds of peach flowers. II. Keep the fire at the same degree of heat, or the Maraschino will have an oily taste. III. When nearly finished, add 10 gallons water, to draw off the faints, which will do for another distillation. Reduce the spirit above distilled to 82 per cent. and you will get 45 gallons. If you have not that quantity, add spirit of the same strength to make it up. Then add 90 gallons sugar syrup 32° Baumé. When you have not used peach flowers in the distillation, take 2 pounds orris root powder, and steep it in 2 gallons alcohol 95 per cent. for 15 days; then filter, and add it to the mixing, not to the distillation.

802. Boitard's Anisette. Charge of the still, water-bath: 20 pounds green anise (washed in river water), 3 pounds star anise (being careful to break the stars only), 1 pound coriander seed (bruised), 40 gallons 95 per cent. alcohol. Put the above into the water-bath with 4 gallons water, and distill. After distilling 35 gallons, add 10 gallons of water to bring off the faints, which may be distilled again. The first 5 gallons of faints may be added to the distilled spirit, which will give 40 gallons aromatized alcohol. Reduce this to 80 per cent. by adding, say 5 gallons distilled water, and then add 90 gallons fine white sugar syrup, 31° Baumé. This will give 135 gallons fine anisette.

803. Chauvet's Anisette. Charge of the still, water-bath: 20 pounds green anise, 1½ pounds coriander seed, 2 drachms neroli, 7¾ pounds star anise (break the stars only), 1½ pounds orris root powdered, 40 gallons 95 per cent. alcohol. Treat precisely as in the last receipt. Reduce the perfumed alcohol to 82 per cent. by adding 4 gallons water, and further add 1½ gallons double orange flower water, and 90 gallons white syrup 31° Baumé. Stir well and let it rest 5 to 8 days, then filter through blotting paper. This will give 135 gallons superfine anisette.

804. Marasquino di Zara. Charge of the still, water-bath: 18 pounds raspberries, 6 pounds orange flowers, 12 pounds sour red cherries (Morello). Mash the whole to a pulp with stones, macerate 24 hours with 7 gallons 95 per cent. alcohol and 7 gallons of water. Distill from off the water, 6 gallons flavored alcohol, and add 14 gallons of the whitest plain syrup about 34° Baumé.

805. Malliorca d'Espagne. Charge of the still, water-bath: 40 gallons 55 per cent. alcohol, 18 pounds green anise seed, 5 gallons river water. Put into the water-bath only 20 gallons of the alcohol, and 5 gallons river water. When 18 gallons are distilled off, add the remaining 20 gallons of alcohol, and continue the distillation until 18 gallons more are obtained, which mix with the 18 gallons previously obtained, and add one drachm of ether to give it age.

806. Elixir Vegetal de la Grande Chartreuse. Macerate 640 parts by weight, each, of the fresh herb of sweet balm and hyssop, 320 parts of fresh root of angelica, 160 of cannella, and 40 each of Spanish saffron and mace, in 10,000 parts of alcohol, for eight days. Then distill it onto a certain quantity (which varies according to the color desired) of fresh balm and hyssop; after a time these are expressed, the liquor sweetened with 1250 parts of sugar, and filtered.

807. Fining with Isinglass for Cordials. Take half an ounce of the best isinglass, and dissolve it over a gentle fire, in a pint of water slightly seasoned with good vinegar, or three tea-spoonfuls of lemon juice. Beat it from time to time, adding a little of the seasoned water. When you obtain a complete solution, gradually add the foaming liquid to the cordial, stirring all the while. Then stir for 15 minutes after it is all added, and let it rest for 3 days; by that time the cordial will be bright and clear. The above quantity is sufficient to clarify 25 gallons of cordial.

808. Fining with Eggs for Cordials. Take the whites of 4 eggs, beat them to a stiff froth, add a little alcohol, and mix it gradually with 20 gallons of cordial, stirring all the while, and it will soon clarify the liquor.

809. Fining with Potash for Cordials. 2 ounces of carbonate of potash (salts of tartar), dissolved in a quart of water, is sufficient to settle 20 gallons of cordial; add and stir as directed above.

810. Fining with Alum for Cordials. 6 drachms of powdered calcinated alum, dissolved in alcohol, is sufficient to clarify 20 gallons of cordial; add as directed above.

811. Filter Bags for Cordials. The filter bags used for rendering cordials transparent are made of flannel, felt, Canton flannel, and other materials, according to the thickness or density of the liquor, and are generally of a conical shape. In order to perform the operation of filtering cordials thoroughly, it is necessary that there should be placed inside of each bag 1 or 2 sheets of filtering paper prepared as follows: Rub each sheet of paper until it becomes soft and flimsy, like a piece of cloth, then tear it in small pieces and place it in a pail, pour over it a little boiling water, and rub and beat it up until it becomes a soft pulp; afterwards add more water, and continue the same as if you were beating up eggs. When the pulp assumes the appearance of a fine paste, fill up the pail with water and throw the contents into the filter; as soon as the water has run through, fill up the filter again so as to keep it full. When the liquid runs clear and limpid let it all run through, and commence filtering the cordial, being careful to keep the filter always full. If the liquor does not run clear, add about 2 ounces of granulated animal charcoal (sifted and fanned from the dust) to each filter. The charcoal should be washed with a little muriatic acid before being used.

812. The Aroma of Cordials. It requires a great deal of experience to combine different perfumes to produce any certain required aroma, a knowledge is necessary of the effect produced by perfumes in combination. The mere facts laid down in receipts will not be sufficient for a liquor manufacturer; he must know just what, and how much of it to use, to counteract what is objectionable, and produce or increase the correct aroma. He will frequently find that a single aromatic perfume fails to give the effect he anticipated; and yet the addition of a mere atom of some other perfume may be all that is required. Thus, the flavor of star-anise is accompanied by a slight, but objectionable odor of bedbugs; a very small addition of green anise and fennel counteracts this. Ambergris, alone, gives scarcely any perfume, but musk brings it out. The quince has a peculiar taste which is corrected by cloves; the after-taste of cinnamon is also destroyed by cloves; vanilla has more flavor if pounded with sugar than when ground with it. Absinthe requires the zest of the lemon to take away its naturally bitter taste. These examples will show that considerable experience is needed to be able to blend perfumes with any degree of success. (*See No.* 767.)

813. Imitation Peach Brandy. Take ½ gallon honey dissolved in water; 3¾ gallons alcohol; ½ gallon Jamaica rum; 1 ounce catechu, bruised to a paste; 1 ounce acetic ether. Add water to make 10 gallons, flavored with 4 ounces of bitter almonds. No coloring required.

Bitters. Bitters are considered as tonic and stomachic, and to improve the appetite when taken in moderation. The best time is early in the morning, or an hour before meals. An excessive use of bitters tends to weaken the stomach. They should not be taken for a longer period than a fortnight at one time, allowing a similar period to elapse before again having recourse to them.

815. To Make French Cognac Bitters. Take 1½ pounds each red Peruvian bark, calisaya bark, bitter orange peel, and sweet orange peel; 2 ounces calamus root; 4 ounces cardamom seeds; 1½ ounces each cinnamon, cloves, and nutmegs; 4 ounces caraway seed, and 3 pounds wild cherry bark. Pound all these ingredients to a coarse powder and steep for 15 days in 45 gallons proof spirit (or 60 gallons spirit 25 below proof), stirring occasionally. Then rack it off, and mix sufficient caramel (*see No.* 694) to make it a dark red; add 15 pounds white sugar dissolved in 15 gallons water; let the whole settle, then filter. If the bitters are required to be of an amber color, omit the wild cherry bark and the caramel coloring.

816. To Make Angostura Bitters. Take 4 ounces gentian root; 10 ounces each calisaya bark, Canada snake-root, Virginia snake-root, liquorice root, yellow bark, allspice, dandelion root, and Angostura bark; 6 ounces cardamom seeds; 4 ounces each balsam of tolu, orangetis, Turkey rhubarb, and galanga; 1 pound orange peel; 1 pound alkanet root; 1½ ounces caraway seed; 1½ ounces cinnamon; ½ ounce cloves; 2 ounces each nutmegs, coriander seed, catechu, and wormwood; 1 ounce mace; 1¼ pounds red saunders, and 8 ounces curcuma. Pound these ingredients and steep them as in the last receipt, in 50 gallons spirit; and, before filtering, add 30 pounds honey.

817. Amazon Bitters. Take 90 gallons plain proof spirit; 3¼ pounds red Peruvian bark; 3¼ pounds calisaya bark; 1⅛ pounds calamus root; 4¾ pounds orange peel; 3½ ounces cinnamon; 3½ ounces cloves; 3½ ounces nutmeg; 2 ounces cassia buds; 6½ pounds red saunders. First mash all the ingredients, put them in the spirit, and let them infuse 14 days, being careful to stir the mixture well twice every day. Then rack off and color with 11 pints brandy coloring, to get a dark red tint. Stir ¼ hour. Dissolve 30 pounds white sugar in 30 gallons water; add, and again stir ½ hour. Let the mixture rest 4 or 5 days, and when bright, bottle. If the red saunders is not used, the color will be a bright amber. This is the finest bitters in the market. Compounded according to the above directions, the dealer will obtain 120 gallons 25 below proof.

818. Boker's Bitters. Take 1½ ounces quassia; 1½ ounces calamus; 1½ ounces catechu (powdered); 1 ounce cardamom; 2 ounces dried orange peel. Macerate the above 10 days in ½ gallon strong whiskey, and then filter and add 2 gallons water. Color with mallow or malva flowers.

819. Stoughton Bitters. To 12 pounds dry orange peel, 3 pounds Virginia snake-root, 1 pound American saffron, 16 pounds gentian root, add 1 pound red saunders. Grind all the above ingredients to a coarse powder, and macerate for 10 days in 20 gallons 65 per cent. alcohol, then filter.

820. Stoughton Bitters. (Another Receipt.) 2 pounds ginsing; 2 pounds gentian root; 1½ pounds dry orange peel; ½ pound Virginia snake-root; 1 ounce quassia; ¼ pound cloves; 3 ounces red saunders wood; 3 gallons alcohol 95 per cent.; 3 gallons soft water. Grind all the ingredients to coarse powder, infuse 10 days, and filter.

821. Wild Cherry Bitters. Take of wild cherry bark, 4 pounds; squaw vine (Partridge berry), 1 pound; Juniper berries, 8 ounces. Pour boiling water over the above and let it stand for 24 hours; strain, and pour again boiling water on the ingredients; let it macerate for 12 hours, then express and filter through paper, so that the whole will make 5 gallons, to which add of sugar, 3½ pounds; molasses, 1½ gallons; tincture of peach kernels, 6 ounces; tincture of prickly ash berries, 3 ounces; alcohol, 2 quarts.

822. To Make Peruvian Bitters. Take 8 ounces red Peruvian bark; 8 ounces orange peel; 1½ drachms each cinnamon, cloves, and nutmeg; and 75 cayenne pepper seeds. Infuse them, well bruised, in 8 gallons proof spirits, for 15 to 20 days, stirring every day. Draw off and filter.

823. Brandy Bitters. Grind to coarse powder 3 pounds gentian root, 2 pounds dry orange peel, 1 pound cardamom seeds, 2 ounces cinnamon, 2 ounces cochineal. Infuse 10 days in 1 gallon brandy, 8 gallons water, and filter.

824. Nonpareil Bitters. Grind to coarse powder 2 ounces Peruvian bark, ½ ounce sweet orange peel, ½ ounce bitter orange peel, 25 grains cinnamon, 25 grains cloves, 25 grains nutmeg, 15 cayenne seeds. Infuse ten days in 2 gallons 65 per cent. alcohol, then filter.

825. Spanish Bitters. Grind to coarse powder 5 ounces polypody, 6 ounces calamus root, 8 ounces orris root, 2½ ounces coriander seed, 1 ounce centaurium, 3 ounces orange peel, 2 ounces German camomile flowers; then macerate with 4¾ gallons 95 per cent. alcohol and add 5¼ gallons water and 1½ ounces of sugar. Filter and color brown.

826. Aromatic Bitters. Macerate 2¾ pounds ground dried small orange apples, ¼ pound ground dried orange peel, 2 ounces ground dried calamus root, 2 ounces ground dried pimpinella root, 1 ounce ground dried cut hops, for 14 days, with 10 gallons of spirit at 45 per cent.; press, and add 2½ pints brown sugar syrup. Filter. Color dark brown.

827. Stomach Bitters. Grind to a coarse powder ½ pound cardamom seeds, ⅛ pound nutmegs, ¼ pound grains of Paradise, ½ pound cinnamon, ¼ pound cloves, ¼ pound ginger, ¼ pound galanga, ¼ pound orange peel, ⅛ pound lemon peel; then macerate with 4¾ gallons 95 per cent. alcohol, and add a syrup made of 4½ gallons water and 12 pounds sugar; then filter.

828. Hamburg Bitters. Grind to a coarse powder 2 ounces agaric, 5 ounces cinnamon, 4 ounces cassia buds, ½ ounce grains of Paradise, 3 ounces quassia wood, ¾ ounce cardamom seeds, 3 ounces gentian root, 3 ounces orange apples dried, 1½ ounces orange peel; macerate with 4¼ gallons 95 per cent. alcohol, mixed with 5¾ gallons water; add 2¾ ounces acetic ether. Color brown.

829. Bitters made with Essences. 40 gallons proof spirit, 1 drachm oil of anise, 1 drachm oil of caraway, ½ drachm oil of cloves, 1 drachm oil of lemon, 1 drachm oil of oranges, 1 drachm oil of cinnamon, ½ drachm oil of bitter almonds, 1 gallon sugar syrup. Cut the oils in 95 per cent. alcohol, and mix. Color with brandy coloring.

830. Bitter Filter. A fine bitter filter may be made according to fig. 5, No. 17.

831. Orange Bitters. Macerate 6 pounds orange peel for 24 hours with 1 gallon water, cut the yellow part of the peel from off the white, and chop it fine; macerate with 4¾ gallons 95 per cent. alcohol for two weeks, or displace (*see No.* 41); then add a syrup made of 4¼ gallons water and 16 pounds sugar. Filter through Canton flannel.

Cider. To make good cider the apples should be allowed to hang on the tree as long as the wind and frosty nights will let them. The riper they are, the better the cider. They are picked up and placed in a large heap, either in the orchard or at the cider mill, and are allowed to lie a few days to complete the ripening process, in which the starch is converted into sugar, and if any are found bruised or rotten, put them in a heap by themselves, for an inferior cider to make vinegar. They are then rasped or ground into pulp. If the weather is cool and the apples are not quite ripe, it is better to let the pulp remain in the vat a few days before pressing out the juice. This gives the cider a higher color, makes it sweeter, and of better flavor.

833. To Press the Apples. The process of pressing is simple, but requires some skill. 4 boards about 6 inches wide are nailed together in a square, the size it is desired to make the cheese, say from 4 to 5 feet. This is placed on the bottom of the press, and a little clean rye or wheat straw, pulled out straight into bundles, is put inside, with the ends extending about a foot all around. The pulp is then put into this rim, forming a layer about 6 inches thick; the straw is then turned on it, and a little pulp placed on the straw to keep it down. The rim is then lifted and a stick is placed at each corner on the layer of pulp added, and the straw turned over it as before. This process is repeated until the cheese is as large as desired, using say from 75 to 100 bushels of apples. When they can be obtained use hair cloths instead of straw, to place between the layers of pomace. The straw, when heated, gives a disagreeable taste to the cider.

834. Sweet or Unfermented Cider. The cider will commence to flow at once, and it is better to let the cheese settle down somewhat before turning the screw. If pressed too much at first, the pulp may burst out at the sides. As the cider runs from the press, let it pass through a hair-sieve into a large open vessel, that will hold as much juice as can be expressed in one day. The cheese is generally allowed to remain under the press all night, and before leaving it in the evening, the screw is turned as tight as possible. In the morning additional pressure is given, and when the cider has ceased to flow, the screw is turned back, the boards taken off, and the corners of the cheese are cut off with a hay knife and the pomace laid on the top. The pressure is again applied, and the cider will flow freely. As soon as it ceases, remove the pressure and cut off 4 or 5 inches of pomace from the sides of the cheese, place it on top, and apply the pressure again as long as any cider will flow. 8 bushels of good apples will make a barrel of cider. In a day, or sometimes less, the pomace will rise to the top, and in a short time grow very thick; when little white bubbles break through it, draw off the liquor by a spigot placed about 3 inches from the bottom, so that the lees may be left quietly behind. The cider is usually put in barrels at once, and sold while sweet.

835. To Preserve Cider. Strictly speaking, we suppose the sweet juice of the apple is not cider, any more than the sweet juice of the grape is wine. It is converted into cider by fermentation. Those who prefer sweet cider resort to various methods for arresting this process, such as putting a handful of powdered clay into each barrel, or 2 or 3 pounds of well burned charcoal. Others add a little mustard seed, about a gill of seed to each barrel. Sometimes a few gallons of cider are placed in the barrel, and then a rag dipped in brimstone is attached to a long tapering bung; this is ignited and the bung loosely inserted. After the brimstone is consumed, the barrel is rolled until the cider has absorbed the sulphurous acid gas. The barrel is then filled up with cider. The sulphurous acid gas acting on the albuminous matter in the cider arrests fermentation. The objection to this method is that, if too much gas is absorbed, it may prove unpleasant, if not injurious. To obviate this, sulphite of lime is now used, which has the property of checking fermentation, making the cider perfectly clear, and imparting an agreeable taste. We have tasted cider preserved in this way that was excellent, and we have also tasted some that was execrable; but this may have been more the fault of the material than of the method. When the cider in the barrel is in a lively fermentation, add as much white sugar as will be equal to ¼ or ¾ pound to each gallon of cider (according as the apples are sweet or sour), let the fermentation proceed until the liquid has the taste to suit, then add ¼ ounce of sulphite (not sulphate) of lime to each gallon of cider; shake well, and let it stand 3 days, and bottle for use. The sulphite should first be dissolved in a quart or so of cider before introducing it into the barrel of cider. Agitate briskly and thoroughly for a few moments, and then let the cider settle. The fermentation will cease at once. When, after a few days, the cider has become clear, draw off and bottle carefully, or remove the sediment and return to the original vessel. If loosely corked, or kept in a barrel on draught, it will retain its taste as a still cider. If preserved in bottles carefully corked, which is better, it will become a sparkling cider, and may be kept indefinitely long. (*See Nos.* 762 *&c.*) Some think that cider, when treated by this method, is liable to induce cramps and loss of appetite, but we have never experienced any such unpleasant results from its use. Another plan, which, however, we have not tried, but is strongly recommended, is to mix 1 pint of hard-wood ashes (hickory is best) and 1 pint fresh slaked lime with 1 quart of new milk; this mixture is to be stirred into each open barrel of cider; after remaining quiet for about 10 hours the pomace will rise to the surface, and may be skimmed off; the clear cider can be drawn off by means of a faucet inserted near the bottom of the barrel; it is advisable to strain it as it is drawn off, to separate any hardened pomace that may remain in it. (*See Nos.* 852 *and* 853.) Whatever method be adopted, the cider must be drawn off into very clean, sweet casks, and closely watched. The moment white bubbles are perceived rising at the bung-hole, rack it again. When the fermentation is completely at an end, fill up the cask with cider in all respects like that already contained in it, and bung it up tight. The most perfect plan for excluding all action of the air from the surface of the cider, and preserving it sweet, is the addition of a tumbler of sweet oil before finally closing the bung-hole. It is not an easy matter to keep cider sweet and pure for any length of time, especially if the weather is warm. If the cider is not made until just before winter sets in, and can afterwards be kept at or near the freezing point, it will remain sweet and excellent.

836. Rules for Making Good Pure Cider. Always choose perfectly ripe and sound fruit.

Pick the apples from the tree by hand. Apples that have been on the ground any length of time contract an earthy flavor, which will always be found in the cider.

After sweating, and before being ground, wipe them dry, and if any are found bruised or rotten, put them in a heap by themselves, from which to make an inferior cider for vinegar.

As fast as the apples are ground, the pomace should be placed in a previously prepared open vat, of suitable size, and with a false bottom, strainer, or clean straw about it. Let the pomace remain about one day, then draw off, return the first, and continue to do so until it runs clear. Let the juice percolate or filter for one or more days. The cider thus extracted will compare closely with any clear, rich syrup, and is alone deserving the name of temperance cider, and may be drank, or used for many purposes, as a choice and superior article. In this way, about one-third of the cider will separate; the balance may then be expressed by the use of the press.

To press out the juice, use a clean strainer cloth inside the curb, with some clean straw intermixed in thin layers with the pomace, and apply the power moderately.

As the cider runs from the vat or press, place it in a clean, sweet cask or open tub, which should be closely watched, and as soon as the little bubbles commence to rise at the bung-hole or top, it should be racked off by a spigot or faucet placed about 2 inches from the bottom, so that the lees or sediment may be left quietly behind.

The vinous fermentation will commence sooner or later, depending chiefly upon the temperature of the apartment where the cider is kept; in most cases, during the first 3 or 4 days. If the fermentation begins early and proceeds rapidly, the liquor must be racked or drawn off and put into fresh casks in 1 or 2 days; but if this does not take place at an early period, but proceeds slowly, three or four days may elapse before it is racked. In general, it is necessary to rack the liquor at least twice. If, notwithstanding, the fermentation continues briskly, the racking must be repeated, otherwise the vinous fermentation, by proceeding too far, may terminate in acetous fermentation, when vinegar will be the result. In racking off the liquor, it is necessary to keep it free from sediment, and the scum or yeast produced by the fermentation. When the fermentation is completely at an end, fill up the cask with cider in all respects like that contained in it, and bung it up tight, previous to which a tumbler of sweet oil may be poured into the bung-hole, which will exclude the oxygen and prevent the oxidation of the surface of the wine.

Sound, well made cider, that has been produced as above directed, and without any foreign mixtures, is a pleasant, cooling and wholesome beverage; while, on the contrary, the acids and drugs added to already impure liquor, retard fermentation, thus adding poison to poison, producing colic, and not unfrequently incurable obstructions.

837. To Make Good Fermented Cider. To make good fermented cider that will keep a year or more without turning too sour to be used for anything but vinegar, is not a difficult matter. The first thing is to exclude all decayed fruit, but it should be quite ripe. Not a drop of water should be used in the process of manufacture. The sweeter the juice, the stronger the cider, and the better it will keep. Put the barrel immediately in a cool cellar—the cooler the better. The fermentation may go on slowly or rapidly, practice differing in this respect. In the former case the liquid is treated in all respects like wine. The cask has a bung in which is fixed, air-tight, a tin tube bent at right angles, or a piece of india-rubber tube. The free end of the tube in either case dips into a vessel of water. This arrangement allows the gases liberated in fermentation to pass out, and the end of the tube being covered with water, air cannot pass in. The bubbling of the gas through the water shows how the fermentation is progressing. When this has ceased, the cider is racked off into clean casks, which are to be full and bunged tightly. Much of the excellence of cider depends upon the temperature at which the fermentation is conducted; a point utterly overlooked by the manufacturers of this liquor. Instead of the apple juice, as soon as it is expressed from the fruit, being placed in a cool situation, where the temperature should not exceed 50° or 52° Fahr., it is frequently left exposed to the full heat of autumn. In this way much of the alcohol formed by the decomposition of the sugar is converted into vinegar, by the absorption of atmospheric oxygen, and thus the liquor acquires that peculiar and unwholesome acidity known as "hardness" or "roughness." When, on the contrary, the fermentation is conducted at a low temperature, nearly the whole of the sugar is converted into alcohol, and this remains in the liquor, instead of undergoing the process of acetification.

838. To Make Fine Cider by Another Process. After obtaining the juice as already directed (*see No.* 836), strain it through a coarse hair-sieve into open vats or close casks. When the liquor has undergone the proper fermentation in these close vessels, which may be best effected in a temperature of from 40° to 55° Fahr., and which may be known by its appearing tolerably clear, and having a vinous sharpness upon the tongue, any further fermentation must be stopped by racking off the pure part into open vessels, exposed for a day or two in a cool situation. After this the liquor must again be put into casks and kept in a cool place during winter. The proper time for racking may always be known by the brightness of the liquor, the discharge of the fixed air, and the appearance of a thick crust formed of fragments of the reduced pulp. The liquor should always be racked off anew, as often as a hissing noise is heard, or as it extinguishes a lighted match held to the bung-hole. When a favorable vinous fermentation has been obtained, nothing more is required than to fill up the vessels every two or three weeks, to supply the waste by fermentation. By the beginning of March the liquor will be bright and pure, and fit for final racking, which should be done in fair weather. When the bottles are filled, they should be set by, uncorked, till morning, when the corks must be driven in tightly, secured by wire or twine and melted resin, or any similar substance.

839. To Prepare Casks for Cider. Cider should never be put into new casks without previously scalding them with water containing salt, or with water in which pomace has been boiled. Beer casks should never be used for cider, or cider casks for beer. Wine and brandy casks will keep cider well, if the tartar adhering to their sides is first carefully scraped off and the casks be well scalded. Burning a little sulphur in a cask will effectually remove must.

840. Canned Cider. Cider may be preserved sweet for years, by putting it up in air-tight cans after the manner of preserving fruit. The cider should be first settled and racked off from the dregs, but fermentation should not be allowed to commence before canning.

841. To Cleanse Cider Barrels. Take lime water and a trace chain and put them in the barrel through the bung-hole, first securing a strong twine to the chain to draw it out with. Then shake the barrel about until the chain wears or scours off all mould or pomace remaining in the barrel. Then rinse well with water; after throwing out the rinsing water put in a little whiskey, turning the barrel to bring it in contact with every part, and pour out all you can.

842. To Clarify and Improve Cider. Cider should be stored in a cool place, and should not be drunk before it becomes sufficiently matured. To improve the flavor of a hogshead of cider, 1½ gallons of good brandy or rum are frequently added, with 2 ounces powdered catechu (dissolved in water), 7 pounds good moist sugar or honey, ½ ounce each bitter almonds and cloves, and 4 ounces mustard seed. These must be well stirred in, and occasionally stirred up for a fortnight, after which it must be allowed to repose for 3 or 4 months, when it will usually be found as bright as wine. Should this not be the case it must be fined with a pint of isinglass finings, or a dozen eggs, and in 2 weeks more it will be fit for use. If the cider be preferred pale, omit the catechu, and instead of the isinglass, fine with 1 quart of skimmed milk. If wanted of a light reddish or rose tint, use ¼ ounce cochineal, and omit the catechu.

843. To Bottle Cider. Preparatory to bottling cider it should be examined to see whether it is clear and sparkling; if not, it should be clarified again, and left for two weeks. The night before it is intended to be put into bottles, the bung should be left out of the cask, and left so until the next day, when it may be bottled, but not corked down until the day after, as, if this be done at once, many of the bottles will burst by keeping. The best corks and champagne bottles should be used, and it is usual to wire and cover the corks with tin-foil, after the manner of champagne. A few bottles may be kept in a warm place to ripen, or a small piece of lump sugar may be put into each bottle before corking, if wanted for immediate use, or for consumption during the cooler portion of the year; but for warm weather and for long keeping this is inadmissable. The bottled stock should be stored in a cool cellar, where the quality will be greatly improved by age.

844. Champagne Cider. Good cider, pale, 1 hogshead; spirit, 3 gallons; honey or sugar, 20 pounds. Mix and let them rest for 2 weeks, then fine with skimmed milk, ½ gallon. This will be very pale; and a similar article, when bottled in champagne bottles, and silvered and labeled, has been often sold to the ignorant for champagne. It opens very brisk if managed properly.

845. Fine Champagne Cider is made as follows:—To 100 gallons of good cider put 3 gallons of strained honey, or 24 pounds of good white sugar. Stir well and set it aside for a week. Clarify the cider with half a gallon of skimmed milk, or ¼ pound of dissolved isinglass, and add 4 gallons of pure spirits. After 2 or 3 days bottle the clear cider, and it will become sparkling. In order to produce a slow fermentation, the casks containing the fermenting liquor must be bunged up tight. It is a great object to retain much of the carbonic gas in the cider, so as to develop itself after being bottled.

846. Champagne Cider. (Another receipt.) 10 gallons of cider, old and clear. Put it in a strong iron-bound cask, pitched inside (like beer-casks); add 2½ pints clarified white plain syrup; then dissolve in it 5 ounces tartaric acid; keep the bung ready in hand, then add 7½ ounces of bicarbonate of potassa; bung it as quickly and as well as possible.

847. To Imitate Champagne Cider. Cider will resemble champagne if you put a tea-spoonful carbonate of soda, 2 tea-spoonfuls fine sugar, and a table-spoonful brandy in a tumbler, and fill it up with sharp cider.

848. How to Imitate Cider. A very fair imitation cider may be produced by using the following receipt:—25 gallons soft water; 2 pounds tartaric acid; 25 pounds New Orleans sugar; 1 pint yeast. Put all the ingredients into a clean cask and stir them up well after standing 24 hours with the bung out. Then bung the cask up tight, add 3 gallons spirits, and let it stand 48 hours, after which time it will be ready for use.

849. To Imitate Sweet Cider. Take water, 100 gallons; honey, 5 gallons; catechu powdered, 3 ounces; alum, 5 ounces; yeast, 2 pints. Ferment for 15 days in a warm place (in the sun if possible); then add bitter almonds, ½ pound; cloves, ½ pound; burnt sugar, 2 pints; whiskey, 3 gallons. If acid be in excess, correct by adding honey or sugar. If too sweet, add sulphuric acid to suit the taste. We should prefer to add cider vinegar for acidulating when necessary.

850. Cheap Imitation Cider. Take water, 35 gallons; sulphuric acid, enough to make the water pleasantly sour; brown sugar, 50 pounds; alum, 4 ounces; ginger, 5 ounces; cloves, 5 ounces; bitter almonds, 6 ounces. Boil the last 4 ingredients in 2 gallons of the water for 2 hours, strain, and add this decoction to the other water. Burnt sugar may be added, to color, if wished. From 3 to 4 gallons of whiskey, if mixed with it, will give more body. It is generally known, we suppose, that bisulphite of lime may be advantageously employed in fresh cider to stop its conversion to vinegar. (*See No.* 835.)

851. Cheap-made Cider. Take of good cider and water, 1 hogshead each; molasses, 50 pounds; alum, dissolved, ½ pound. Brimstone matches to stop fermentation, by burning.

852. To Keep Cider Sweet. Allow the cider to work until it has reached the state most desirable to the taste, then add 1½ tumblers grated horseradish to each barrel, and shake up well. This arrests further fermentation. After remaining a few weeks, rack off and bung up closely in clean casks.

853. To Clear Cider. To clear and improve cider generally, take 2 quarts of ground horseradish and 1 pound of thick gray filtering paper to the barrel, and either shake or stir until the paper has separated into small shreds, and let it stand for 24 hours, when the cider may be drawn off by means of a syphon or a stop-cock. Instead of paper, a preparation of wool may be taken, which is to be had in the market here, and which is preferable to paper, as it has simply to be washed with water, when it may be used again.

854. To Clean a Foul, Sour Cask, and Restore the Taste of the Wood. In order to accomplish this, dissolve about 1½ pounds lime in 5 gallons boiling water. Rinse the cask to be restored with this liquid, and afterwards with boiling water. If the cask is very foul, it should also be rinsed with very dilute sulphuric acid after the lime water, and afterwards with boiling water. As a general thing, however, the lime water and boiling water are sufficient. To restore the natural taste of the wood, mash up in a mortar a handful of juniper berries and put them in the tainted cask, then pour over them several gallons boiling water, roll the cask violently, and set it first on one end, and then upon the other.

855. To Make Barrels Tight. Dissolve in a water-bath 1 pound leather scraps and 1 ounce oxalic acid, in 2 pounds water, and dilute gradually with 3 pounds warm water. Apply this solution to the inside of the barrel, where, by oxidation, it will assume a brown color and become insoluble in alcohol. This coat closes all the pores of the wood, and does not crack or scale off.

Brewing. The art of brewing is simply and easily understood, cleanliness and attention being the principal points to be considered. It consists of five operations, namely: mashing, boiling, cooling, fermenting, and cleaning. The first process is simply to obtain an infusion of the malt. In the second, this infusion of malt is further impregnated with the flavor of the hops in the boiling, which is requisite for the preservation of the beer. In the third, this decoction or infusion is cooled down to the necessary heat for fermentation, which is excited with yeast, and which fills it with carbonic gas, giving to the liquor that pungent taste for which it is esteemed. After this it is fined, or cleansed, to render it fit for drinking.

857. Brewing Utensils. These utensils in a small way (say for a hogshead, or 54 gallons of beer), will consist of a copper capable of containing about 70 gallons; and if the brick edge at the top is made sloping, and covered with lead, it will prevent any waste of the wort in the boiling. A mash tub, with a false bottom about 3 inches above the other bottom, bored full of small holes, to prevent the malt stopping up the hole of the faucet. In many cases, for the sake of economy, an old worn-out birch-broom is cleaned and fastened before the hole of the faucet; and others again have two pieces of wood nailed together, and bored full of holes, which is fitted to the side of the tub, so as to cover the hole of the faucet. Any one of these contrivances is to prevent the malt or grains from flowing out with the wort, which would spoil its transparency. The tub must be sufficiently large to hold 10 or 12 bushels of malt, with plenty of room for mashing or stirring. An underback, to receive the wort from the mash tub. An oar, or rudder, to stir up the malt in the mash tub. Two or three coolers. These should be broad and flat, that the wort may cool quickly; for if the wort is too long cooling, it is likely to become sour in the coolers. These should also be raised a little at one end, that the wort may be run off at the lower end without being disturbed or shaken, and also that the sediment which falls down may not be again mixed with the wort. A fermenting tun. The mash-tub, when emptied of the grains, will also serve for this purpose. Casks, and oak stands for the casks and tubs to be placed on. The whole of these articles should be of a suitable size with the copper, which the cooper will always regulate, or in proportion to the quantity intended to be brewed.

858. Mashing. The purpose of mashing is to convert as much of the flour of the malt as possible into sugar, so that the extract drawn from it may contain the greatest amount of saccharine matter which it is capable of giving. To accomplish this perfectly will depend upon many contingencies—the heat of the water used in mashing, its quality, whether hard or soft, the most perfect mixing of the malt with the water, and the time of their remaining together. High-dried malt does not produce so much saccharine matter as pale malt. On the proper temperature of the liquor used will depend the goodness, flavor, and clearness of the extract drawn. When too high, or near the boiling point, the flour of the malt will be set, forming a kind of paste or starch, and the extract obtained will be little better than water. The surface of the grains after the mashing process is concluded will be covered with specks of white meal. The same appearance also shows itself when unmalted corn has been mixed with the malt. If the temperature be too low, the wort will be poor and devoid of strength, because the heat of the water is not sufficient to convert the flour of the malt into sugar, or to extract the saccharine matter from it. For pale malt the heat of the water must be higher than for brown, and so much the lower in proportion as the malt is browner. Thus, for the pale malt, the heat of the water for the first mash should be 178° Fahr.; for the second, 182°. Pale and amber mixed, or pale malt approaching to amber, 172° for the first mash; second, 178°. All amber, the first 170°; second, 176°. For very brown, or brown malt, such as is used for porter, 154° for the first; second, 164°. When hard water is used, the heat in each case should be about 2° less. An equal portion of pale, amber, and brown, or half pale and half brown—first heat, 160°; second, 166°. The time for the standing of the mash is from an hour and a half to two hours. In the summer months the mash should not stand so long by a quarter of an hour as it does in the winter. Heat the water in the copper to the required degree by Fahrenheit's thermometer. In taking the heat in the copper, if it is too hot, add cold liquor to bring it to the desired degree; but be careful to stir the hot and cold well together and mix it intimately, because the cold water, being heavier than the hot, sinks to the bottom. The heat of the water being now reduced to the proper degree in the tun, the malt must be stirred in gradually. It is best for one person to throw it in whilst another mixes it well and thoroughly by means of the oar, so that there may be no lumps or clots of malt left in it. The remainder of the water should be added by degrees, as the mash becomes too stiff to stir, until the whole is used. Reserve about ½ bushel of the malt to throw over the top when the mashing is finished. Cover the top of the tun with malt-sacks or cloths, to keep in the heat, and let it stand the required time. Turn the tap partially, to allow the wort to run out slowly, and draw off some in a pail or bucket. As the first running will not be clear, it must be put gently back into the tun; and if the second running is not sufficiently clear, turn the tap again, and let it remain a few minutes before drawing it off; then turn the tap partially as before, and draw it off into the underback, which must be placed underneath to receive it. As the wort runs out more slowly, the tap must be turned more fully, until the whole is nearly run out, and the bed of the grains looks dry; then turn the tap, to prevent any more running off. While the mash is standing, the copper should be again filled with water, and heated to the required degree for the second mash; this should be ready by the time the first wort is drawn off; then, with a bowl or ladle, pour over the top of the grains, as gently as possible, about half as much water as for the first; cover the mash-tun, let it remain about ten minutes or a quarter of an hour, and draw it off as before, pouring back the first running until it is fine. The wort from the first mashing is always the best and richest in saccharine or sweet matter. The proportion of wort to be obtained from each bushel of malt depends entirely on the proposed strength of the liquor required. To ale or beer of a superior kind the produce only of the first mashing should be used. For ordinary or usual drinking ale, take the produce of the first and second mashings, mix them well, and ascertain the gravity by a *saccharometer.* This is an instrument used by brewers for ascertaining the strength of wort; it is similar in principle to the hydrometer, but its scale denotes the pounds per barrel in excess of the weight of a barrel of water. The barrel or 36 gallons of water weighs 360 pounds; and, in examining a quantity of wort, if the saccharometer marks 60, it means that a barrel (36 gallons) of the wort would weigh 60 pounds more than a barrel of water, or 420 pounds. It is a sort of specific gravity, in which 360 is the unit instead of 1000; from which it can be seen that a saccharometer gravity of 420, as compared with 360, would be the same as 1166⅔ true specific gravity as compared with 1000. Some brewers express the strength of their wort by the whole weight of a barrel, others use only the excess of weight; thus, in the example above, some would call it wort of 420 pounds, others would say 60 pounds; either way is plain; the figures showing which plan is adopted. The usual limit for ale or beer is from 50 to 60 pounds, and for a very strong ale from 90 to 120 pounds per barrel. That made at the first gravity will be a brisk, lively and sparkling drink; but the last will be more heavy and glutinous, and can only be imperfectly fermented.

859. Boiling. As soon as the water is taken from the copper for the table-beer, damp the fire with ashes or cinders, and put in the wort. For every bushel of malt used, allow 1 pound hops, previously soaked in water taken from the first mash at 160° of heat; add half of them at first, and the other half after the wort has boiled half an hour. 2 pounds of hops by this method are considered to be equal to 3 pounds used in the ordinary way. The water in which they are steeped is strained off and put into the tun instead of the copper, which preserves the flavor of the hops. Let the wort boil as briskly as possible, for the quicker it is boiled the sooner it will break. Try it occasionally in a glass, and see if it has separated into large flakes; if it has not, boil it a little longer; when nearly ready, it will appear to be broken into fine particles. The extremes of under and over-boiling must be avoided, for when over-boiled it is with difficulty fined again in the casks.

860. Cooling. When the wort is ready, damp the fire, and draw it off into the coolers, keeping the hops well stirred to prevent their being burnt to the bottom; strain it through a hair-sieve to take off the hops. The coolers should be as shallow as possible, that the wort may not be too long in cooling, or it may chance to get sour, and should be of the same depth in each, that it may cool equally. When the first wort is drawn off, return the hops again into the boiler, with the wort for the table-beer, and let it boil quickly for one hour and a half; and if 1 pound coarse sugar or molasses, and 1 ounce salt, be added to every 10 gallons wort in the boiling, it will be much improved. When the wort has been cooled down to 75 or 80 degrees of heat by the thermometer (this will depend on the state of the atmosphere, for when the weather is warm it should be cooler), draw it off into the fermenting tun, without disturbing the sediment at the bottom, which gives the ale or beer a disagreeable taste. This is always observed by the Scotch brewers, but others consider that it feeds the beer, which it certainly does, and always use it; for whether it is the oleaginous quality of the hops, or the gluten extracted from the malt, which is precipitated by the boiling, it cannot be of any injury to the wort. If it is the first, it is of essential service to give the full flavor of the hops. In each case it will be thrown off in the working.

861. Fermentation. 3 pints good white fresh yeast will be about the quantity required to work a hogshead of beer; but in larger brewings this will depend on the quantity there is in a body, the gravity, and heat of the atmosphere—thus, the lower the gravity, the greater the bulk, and the warmer the weather, the less yeast must be used in proportion to work it, and *vice versa.* 3 pints being sufficient for a hogshead, a gallon will work 4 or 5 hogsheads in a body of the same gravity. First mix the yeast with a gallon or two of the wort, and a handful or two of bean or wheat flour in the fermenting tun; when the fermentation is brisk, pour over another portion, and as soon as the wort is at the proper degree of temperature run it into the tun, reserving out some of the ferment, to feed the beer as occasion may require. When it becomes languid, or if there is sufficient yeast in, it may be left out altogether. The fermentation should be gradual at first; for if it goes on too quickly the beer is likely to become foxed, that is, to have a rank and disagreeable taste. The next morning the beer should have a thin white creamy head; then, with a bowl or ladle, well rouse and mix it together. If, however, the fermentation has not been favorable, add some of the ferment; and if rather cold, wrap some sacks or old carpet round the tun, and place some more sacks over the top; also keep the door and windows closed. Or take a clean cask (the size according to the quantity of the gyle, or brewing), and fill it full of boiling liquor; bung it close, and put in the tun. In the evening rouse the head well in again; the next morning the beer should have what is termed a cauliflower-head; remove with the skimmer any patches of dark-brown yeast, and mix it well up together again. After the yeast has risen to the top, it will form a thick yeasty appearance, which should be skimmed off as soon as it is inclined to fall. A portion should then be taken out, tried with the saccharometer, and noted. If not sufficiently fermented, it should be tried every two hours until it is so, and the head may be skimmed off at the same time. When sufficiently reduced, cleanse it into the casks.

862. Cleansing. In cleansing ale or beer, the yeast should be skimmed from the top, and the liquor drawn off gently, so as not to disturb the bottoms. The casks should be plugged a little on one side, that the yeast may work and discharge itself at the bung-hole. A tub or pan must be placed underneath to receive the yeast as it works over. The greatest attention should be paid to the filling up of the casks with the wort that is left, which should be done every half hour at first, and as the working becomes more slow, every 3 or 4 hours, that the yeast may continue to discharge itself, otherwise it will fall to the bottom, and render the beer harsh and unpleasant, and liable to be excited on every change of the weather; but by attending to these precautions, this will be avoided, and the working of the beer will be sooner over. When the yeast has ceased to discharge itself, plug the casks upright, mix a pound of the best hops with some old ale or beer, and scald them in it over the fire. If the ale or beer is required to be drunk soon, this mixture should be added warm, otherwise add it when cold. Mix it well into the cask by means of a long stick, and bung the cask close; make a spile-hole near the bung, and put in a spile rather loosely at first, and after two or three days knock it in firmly.

863. Important Hints on Brewing. Small beer will require rather more yeast to work it than strong beer or ale. A portion of the wort at the temperature of 85 degrees should be mixed at first with the yeast. When the fermentation has commenced, the rest of the wort may be run into the tun at the heat of 75 degrees. It will not work so long nor so strongly as ale, and may be casked the next day. Attend to the filling of the cask as directed for ale. In about two days the fermentation will have subsided, and the cask should then be bunged close. The fermentation will always show whether the degrees of heat have been well taken, and the extract well made. If too high, the air-bladders on the head will be about as large as a dollar piece. If too low, there will be few or no bladders, or very small ones; but when well taken they will be in size about that of a 2 cent piece. The proportions of hops used for beer should be in accordance with the time it is to be kept. If for immediate use, 3 pounds will be sufficient for a coomb of malt (4 bushels). From 1 to 2 years, 4 pounds; old beer, 5 or 6 pounds. The same if the wort is very rich; or in proportion to its gravity use more hops, because beer or ale made from rich wort is always intended for long keeping. In general, 4 or 5 pounds of hops per coomb (4 bushels) is used for ales; but for porter, 5 or 6 pounds, and for bitter ale, about 8 or 10 pounds; but in all cases care should be taken that the hops are of the best quality. The private brewer will find about ¼ pound of raspings of quassia equivalent to 6 pounds of hops for preserving ale and imparting a pleasant bitter. Beer brewed for immediate use may be made from all pale malt, as it is more readily fermented than that from the browner sorts. It will not keep so well, and may be brewed almost in the hottest weather, as it need not be cooled below 70 or 75 degrees. A mixture of pale and amber malt should always be used for keeping beer, and the wort cooled down to 60 or 70 degrees before it is put into a state of fermentation; hence, from Autumn to Spring, or the months of October to March, have ever been deemed the most favorable months for brewing the best malt liquor, the former being considered the most fitted, as the beer has so many cold months immediately succeeding, for it to ripen and grow fine in; besides, it does not want such watching and tending as the March beer does, in putting in and taking out the spile or peg on every change of the weather. The proportion of wort to be obtained from every bushel of malt will depend entirely on the proposed strength of the liquor required. For ale or beer of a superior kind, the produce of the first mashing only should be used; but if the ordinary or usual driking ale is wanted, take the produce of the first and second mashings, and use the third for table beer.

864. Flavoring Beer. There are several simple and innoxious articles which can be used for this purpose by the private brewer—namely, Spanish liquorice, liquorice root, cardamom and caraway seeds, and dried orange peel powdered; these are very excellent when used judiciously. Honey is also an excellent assistant to beer and ale; about 2 pounds to a quarter (8 bushels) of malt being put into the copper just before the wort is turned out, or long enough to melt and incorporate with the mass. The same plan should be adopted with everything used for this purpose—that is, throwing it in when the wort is at the full boiling point, for then it will not fall to the bottom without mixing. When, however, Spanish liquorice is used, it will be necessary to tie it in a net bag and suspend it. Salt and ground ginger, or salt and any other spice, are excellent for cleansing beer.

865. Porter Brewing for Families. To make this beverage, three sorts of malt are required, namely: pale, brown, and blown malt. The peculiar flavor of this liquor is given by the brown and blown malt, and no other material or ingredient whatever is required different from other sorts of beer. The mixture of malt may be composed of half pale or amber, and half brown malt; or, take for a hogshead, 4 bushels of pale or amber malt, 2 of brown, and 14 pounds of patent blown malt, and 6 pounds of the best brown hops. These proportions will make excellent porter, but the following may be used for a second-rate quality:—2½ bushels of amber, 1½ bushels of brown malt, and 4 pounds of hops, with sufficient burnt sugar (*see No.* 694) to give the desired color; or it may be brewed with all amber malt, using blown malt, or sugar coloring, instead of the brown malt. The water for mashing must be lower than for beer or ale, and be reduced to 164 or 166 degrees for the first mash, according to the instructions already laid down. All the processes are conducted the same as for beer or ale, with this exception, that blown malt is boiled with the wort in a copper, and the second malt, if boiled separate, should be boiled violently for 2 or 3 hours; and as there is generally but one quality of porter, the two kinds of wort are run together into the tun. 28 gallons of cold water may be run into the tun for table porter, which should be managed as table beer. If the color is not sufficiently high it may be heightened by using a pound of Spanish liquorice with the wort in the boiler, or by the addition of burnt sugar (*Caramel, see No.* 694.)

866. Hints on Fermentation. The fermentation of beer or ale is a very important part of the process of brewing. The quantity of extract obtained from the malt depends greatly upon the heat of the water used for mashing, and on the mashing process being properly conducted; but whether that extract be rich or poor, the flavor of the beer or ale, and its ultimate success in the cellar, depends upon the wort being properly and sufficiently fermented in the tun and casks. Fermentation increases the heat and decreases the gravity of the wort, altering altogether its original character by a decomposition of its parts, or a conversion of its saccharine principle into alcohol, which gives to it that vinous pungency for which it is esteemed. If the fermentation is not carried far enough, the abundant sweet principle of the wort will not be sufficiently changed to give it the necessary vinous taste, and it will be sickly and cloying, deficient of strength, and liable to become ropy. When the fermentation is carried too far in the tun, the vinous flavor is partly lost; and if still lower, the yeast becomes, as it were, fixed in it, from the ale or beer having lost its natural energy to throw it off, and it will have a flat, stale, and disagreeable taste. Fretting (*see No.* 757) then ensues in the cask, and from being deficient of body it soon becomes sour, unless speedily drunk. All beer for keeping should be fermented in the tun to about one-fourth its original gravity, in a temperature of the gyle not exceeding 70 degrees. Lighter beer about one-third; but in no case should it be allowed to reach so far as one-half. In winter, the fermentation of weak beer must not be carried quite so far as in the summer, as more unfermented matter must be left to nourish it in the cask during the cold weather, which will counteract its ripening. Some allowance should also be made for the time the ale or beer is intended to be kept. Strong wort will bear a greater proportionate fermentation than weak wort, and consequently be stronger and more sparkling. Beer of this kind, intended to be kept, should be fermented so low as to ensure transparency and softness, with a proper degree of strength, for it will have time to bring itself round. Still, care must be taken to leave a sufficient quantity of unfermented matter for the supply of the gradual decomposition, the quantity left being proportionate to the time the beer is intended to be kept. Wort of 50 or 60 degrees gravity (*see No.* 858) will keep well for 2 or 3 years, if reduced to two-fifths, or at least one-fourth. Ale is not fermented so much as beer, therefore a considerable portion of the saccharine matter still remains in the liquid, apparently unaltered. In conducting this process, both the thermometer and saccharometer must be the guide;—the last is indispensable. The results given by these should be carefully noted in a book kept for the purpose, with the heat of the atmosphere at the time the observations are made, which will serve as a guide for any future brewing. As soon as the head forms a brown, thick, yeasty appearance, and is inclined to fall, it must be immediately skimmed off. Particular attention must be paid to this point. It is at all times better to skim it before it begins to drop, than allow it to pass again through the beer, which will give it a rank, disagreeable taste, termed "yeast bitten;" neither will it fine well in the cask. After the head is skimmed off, a portion should then be taken out, tried by the saccharometer, and noted; and if it is not sufficiently fermented it should be roused well up, and skimmed every two hours until the required gravity is nearly attained, when it should be watched with the greatest attention, and cleansed with a little salt and bean-flour, and any other flavoring ingredient may then be added, such as ground ginger, cardamom, caraway seeds, &c., and well mixed with it immediately it is reduced to the desired point.

867. The Acetous Fermentation may arise from premature fermentation, through the mashing heat being taken too low, when it may commence in the tun, underback, or coolers. If in the mash tun, the wort will ferment very rapidly, and produce a large quantity of yeast; but of course the liquor will be soured, therefore less yeast will be required to ferment it. When the first mash is affected, all the subsequent ones will share the same fate, and no extra quantity of hops or boiling that may be given to it will restore it to a sound condition. It may also arise from the mashing heat being taken too high. When this is the case, the fermentation is languid, the yeast head is very low, and appears brown or fiery, accompanied with a hissing noise, and occasionally it will appear as if boiling. A larger quantity of yeast than usual is necessary to be added to wort of this description, to force the fermentation, and to discharge the yeast freely, in order that as little as possible may remain in the liquor, which would otherwise fret and become sour. The acetous fermentation may also arise from premature fermentation, either in the underback or coolers; hence, fretting ensues, and the liquor continually generates acidity.

868. To Correct Acidity in Beer. Acidity in beer may be neutralized by chalk, lime, alkalies, &c.; but it cannot be totally destroyed without spoiling the liquor.

869. Bittern. This is an adulterating mixture employed by brewers to impart a false bitter and strength to their liquors. Boil 4 parts Spanish liquorice in sufficient water until dissolved, and evaporate to the consistence of cream. Then add to it 1 part extract of quassia, 1 part powdered sulphate of iron, 2 parts extract of cocculus indicus, and 8 parts molasses.

870. Bitter Balls. These are used as a fraudulent substitute for hops in making beer, and are different in composition, to suit different kinds of malt liquor.

For ale: 2 pounds powdered gentian, and 1 pound extract of gentian, mixed with sufficient molasses to make a paste. Divide into ½ pound rolls.

For pale ale: 1 pound crude picric acid, 3½ pounds ground chamomiles, and ½ pound grains of Paradise, mixed with syrup.

For porter or stout: either of the above, with the addition of 1½ pounds Spanish liquorice softened with a little boiling water.

871. Fining for Ale or Beer. It frequently happens that malt liquor, especially porter, with all the care bestowed upon it in brewing, will not turn out sufficiently fine to meet the taste and eye of the consumer, in which case it is usually subjected to the operation of clarifying. For this purpose 1 ounce isinglass is put into 1 quart weak vinegar, or still better, hard beer, and when dissolved, a sufficient quantity of good beer may be added to make it measure 1 gallon. This mixture is called finings, 1 to 2 pints of which is the proper quantity for a barrel. The method of using it, is to put the finings into a bucket, and to gradually add some of the beer, until the bucket is three parts full, during which time it is violently agitated with a whisk, and this is continued until a good frothy head is raised upon it, when it is thrown into the barrel of beer, and the whole well stirred up, by means of a large stick shoved in at the bung-hole. In a few days the beer will usually become fine.

872. To Ascertain Whether Malt Liquor may be Clarified by Fining. In some bad sorts of beer, isinglass will have no effect. This may be ascertained beforehand, by trying some in a long glass tube, or vial, with a little of the finings. These should be well shaken together, and then set aside for a short time, when it will be found that the finings will rise to the top, leaving the central portion of the beer clear, if it be in a proper condition for clarifying; but if, on the contrary, they sink to the bottom, and the liquor still keeps foul, no quantity of finings, however great, will ever clarify it.

873. To Clarify Obstinate Ale. This latter defect may be remedied by proceeding to fine it after the manner above described, and then adding, after the finings have been well rummaged up, either 1 spoonful oil of vitriol or gum catechu, dissolved in ½ pint warm water, again stirring well for a quarter of an hour. Or 1 or 2 ounces tincture of catechu may be used instead, mixed with a little water. Either of these additions acts chemically on the finings, in the same way as good beer does, precipitating them along with the foulness, and thus brightening the liquor. The addition of a handful of hops, previously boiled for 5 minutes in a little of the beer, and then added to the barrel, and the whole allowed to stand for a few days, before proceeding to clarify it, will generally have the same effect.

874. To Ripen Beer. The addition of a small lump of white sugar to each bottle of ale or beer, and a tea-spoonful of moist sugar to each bottle of porter at the time of corking, will render it fit for drinking in a few days in ordinary weather. A raisin or lump of sugar candy is often added to each bottle with a like intention. The Parisians bottle their beer one day, and sell it the next. For this purpose, in addition to the sugar as above, they add 2 or 3 drops of yeast. Such bottled liquor must, however, be drunk within a week, or else stored in a very cold place, as it will otherwise burst the bottles, or blow out the corks.

875. To Give Beer the Appearance of Age. The addition of a very little diluted sulphuric acid to new beer will give it the appearance of being 1 or 2 years old. Copperas, alum, sliced lemons, oranges, and cucumbers, are also frequently employed by brewers for the same purpose.

876. Beer Heading. Alum and green copperas equal parts, both in fine powder; mix. Or, alum, copperas, and common salt, of each equal parts; mix. Used by brewers to make their beer keep its head.

877. To Remedy Mustiness in Beer. To each hogshead add 1 pound new hops boiled in a gallon of the liquor, along with 7 pounds newly-burnt charcoal coarsely bruised, and a 4 pound loaf of bread cut into slices and toasted rather black; rouse well every day for one week, then stir in moist sugar 3 or 4 pounds, and bung down for 2 weeks.

878. To Remedy Flatness in Beer. Stir a few pounds of moist sugar into each hogshead; fermentation will ensue in a few days, and the liquor become brisk. On the small scale, the addition of a few grains carbonate of soda or prepared chalk to each glass will make the liquor brisk and carry a head; but it must be drunk within a few minutes, else it becomes again flat. This is an excellent method when home-brewed beer becomes sour and vapid.

879. To Recover Frosted Beer. Frosted beer is best recovered by the addition of a few hops boiled in a little sweet wort; or by adding a little moist sugar or molasses to induce a fresh fermentation.

880. Foxing or Bucking Beer. Add some fresh hops, along with some bruised mustard seed, to the beer. Some persons add a little made mustard, or solution of alum or catechu, or a little diluted sulphuric acid, and stir it well; and in a week or 10 days afterwards, further add some bean-flour, molasses, or moist sugar.

881. To Remedy Ropiness in Beer. Add a little infusion of catechu and some fresh hops to the beer, and in a fortnight stir well, and the next day fine it down.

882. German Beer Bouquet. According to Dr. Boettger, this liquor consists of a solution of the essential oil of lemons in light petroleum oil, and a coarse fusel oil, containing spirit colored by turmeric.

883. Spring Beer. Boil down 3 small bunches each of sweet fern, sarsaparilla, wintergreen, sassafras, prince pine, spice wood, in 8 gallons water to 6 gallons of decoction or extract; strain; 4 gallons of water boiled down to 3 gallons of decoction, with ½ pound hops; strain; mix the two extracts or decoctions together; dissolve in them 1 gallon of molasses, and, when cooled to 80° heat, 1½ pound of roasted bread soaked in fresh brewers' yeast; fill up a 10-gallon keg; when fermentation is over mix with it the white of 1 egg beaten to froth; bung it, and bottle when clear.

884. Spruce Beer. Boil 9½ gallons of water; let it cool down to 80° Fahr., and then dissolve 9 pounds of sugar in it, having previously mixed with it 1 ounce of essence of spruce; then add 1 pint of good brewers' yeast, and pour it in a 10-gallon keg until fermentation is over; then add a handful of brick powder and the white of 2 eggs beaten to a froth; mix with the beer, and let it stand till clear, then bottle.

885. To Make White Spruce Beer. Dissolve 10 pounds loaf sugar in 10 gallons boiling water, add 4 ounces essence of spruce; when nearly cold add ½ pint yeast. Keep in a warm place. Next day strain through flannel, put into bottles and wire the corks.

886. To Make Wood's Spruce Beer. Boil ½ pint essence of spruce, 5 ounces each of bruised pimento and ginger, and 5 or 6 ounces hops in 3 gallons water for 10 minutes. Then add 3 quarts molasses and 11 gallons warm water. When lukewarm add 1 pint yeast; ferment for 24 hours and bottle, as in last receipt. This will also make a white beer by substituting an equivalent of loaf sugar instead of the molasses.

887. To Make Spruce Beer. Take 2 ounces each hops and chips of sassafras root, 10 gallons water; boil twenty minutes, strain, and turn on, while hot, 1 gallon good molasses, and add 2 table-spoonfuls each essence of ginger and essence of spruce; 1 table-spoonful pounded allspice. Put into a cask, and when cold enough add 1 quart yeast; let it stand 24 hours; draw it off or bottle it.

888. Essence of Spruce. Take of the young branches of black spruce (abies nigra), make a decoction with water (*see No.* 34) and evaporate to the consistence of molasses. This is used for fabricating spruce beer—a right pleasant drink when it is fresh.

889. Root Beer. Take sarsaparilla (American), 2 pounds; spice wood, ½ pound; guaiacum chips, 1 pound; birch bark, ¼ pound; ginger, ½ ounce; sassafras, 4 ounces; prickly-ash bark, ½ ounce; hops, 1 ounce. Boil for 12 hours over a moderate fire, with sufficient water, so that the remainder shall measure 5 gallons, to which add tincture of ginger, 8 ounces; oil of wintergreen, 1 ounce; alcohol, 1 quart. This prevents fermentation. To make root beer, take of this decoction 1 quart; molasses, 8 ounces; water, 2½ gallons; yeast, 4 ounces. This will soon ferment and produce a good drinkable beverage. The root beer should be mixed, in warm weather, the evening before it is used, and can be kept for use either bottled or drawn by a common beer-pump. Most people prefer a small addition of wild cherry bitters or hot drops to the above beer. (*See Nos.* 821 *and* 891.)

890. Puffer's Root Beer. Prince's pine, 2 ounces; wild cherry, 2 ounces; hemlock bark, 2 ounces; wintergreen, 4 ounces; sassafras bark, 4 ounces; birch bark, 4 ounces; spice bark, 4 ounces; Jamaica ginger, 2 ounces; white mustard seed, 1 ounce. Put in a percolator and cover with boiling water; let it stand till cold, then strain; add to it enough boiling water to make 4 gallons. Take 1 gallon of this, add 1 gallon of molasses, or the same amount of syrup; to this add 8 gallons of water and about 1 pint of yeast. 1 pint of alcohol added will much improve its flavor, and it will keep longer.

891. Hot Drops. Take of tincture of myrrh, 1 ounce; tincture of capsicum, 2 ounces.

892. To Make Ottawa Root Beer. Take 1 ounce each sassafras, allspice, yellow dock, and wintergreen; ½ ounce each wild cherry bark and coriander; ¼ ounce hops and 3 quarts molasses. Pour boiling water on the ingredients and let them stand 24 hours; filter the liquor and add ½ pint yeast, and it is ready for use in 24 hours.

893. To Make Superior Ginger Beer. Take 10 pounds of sugar, 9 ounces lemon juice, ½ pound honey, 11 ounces bruised ginger root, 9 gallons water, 3 pints yeast. Boil the ginger half an hour in 1 gallon water; then add the rest of the water and the other ingredients, and strain it when cold. Add the white of an egg beaten, and ½ an ounce essence of lemon. Let it stand 4 days, then bottle, and it will keep many months.

894. To Make Ginger Beer. Put into 1 gallon boiling water, 1 pound lump sugar, 1 ounce best unbleached Jamaica ginger well bruised, ¾ ounce cream of tartar and 2 lemons sliced; stir the ingredients frequently in a covered vessel until lukewarm; then add 1½ or 2 ounces yeast, and keep it in a moderately warm place so as to excite a brisk fermentation; the next day rack and strain through flannel; let it work for a day or two, then strain it again and bottle, wiring down the corks.

895. Ginger Beer Without Yeast. Boil 1½ pounds bruised ginger in 3 gallons water half an hour; then add 20 pounds white sugar, 1 pint lemon or lime juice, 1 pound honey, and 17 gallons water; strain through a cloth. When cold add the white of 1 egg, and ½ fluid ounce essence of lemon; after standing 3 or 4 days, bottle.

896. To Make Ginger Pop. Take 5½ gallons water, ¾ pound ginger root bruised, ½ ounce tartaric acid, 2¼ pounds white sugar, whites of 3 eggs well beaten, 1 small tea-spoonful lemon oil, 1 gill yeast; boil the root for 30 minutes in 1 gallon of the water, strain off, and put the oil in while hot; mix. Make over night; in the morning skim and bottle, keeping out sediments.

897. To Make Ginger Pop. Take 2 ounces best white Jamaica ginger root, bruised; water, 6 quarts; boil 20 minutes, strain, and add 1 ounce cream tartar, 1 pound white sugar; put on the fire and stir until all the sugar is dissolved, and put in an earthen jar; now put in ¼ ounce tartaric acid, and the rind of 1 lemon; let it stand until 70° Fahr., or until you can bear your hand in it with comfort; then add 2 table-spoonfuls of yeast, stir well, bottle for use and tie the corks. Make a few days before it is wanted for use.

898. Wahoo Beer. Boil for 6 hours in 4 gallons water, 1 ounce each sarsaparilla, Solomon's seal, nettle root, and sassafras; 2 ounces each burdock root, comfrey root, and Prince's pine; 2 ounces sweet fern, ½ ounce wintergreen, and 4 raw potatoes cut up fine. Strain, and add 1 quart molasses for each 3 gallons of the strained liquor, and a browned loaf of bread. When cool, put in 1 pint of good yeast, and let it ferment for 24 hours. It will then be ready to be put in bottles or a keg.

899. Lemon Beer. Put into a keg 1 gallon water, 1 sliced lemon, 1 table-spoonful ginger, 1 pint good syrup, and ½ pint yeast. In 24 hours it will be ready for use. If bottled the corks must be tied down.

900. Imperial Pop. Cream of tartar, 3 ounces; ginger, 1 ounce; white sugar, 24 ounces; lemon juice, 1 ounce; boiling water, 1½ gallons; when cool, strain, and ferment with 1 ounce of yeast, and bottle.

901. Girambing, or Limoniated Ginger Beer. Boil 4½ ounces of ginger with 11 quarts water; beat up 4 eggs to a froth, and add them with 9 pounds sugar to the preceding. Take 9 lemons, peel them carefully, and add the rind and juice to the foregoing. Put the whole into a barrel, add 3 spoonfuls of yeast, bung down the barrel, and in about 12 days bottle it off. In 15 days it will be fit for drinking, but it improves by keeping.

902. Ginger Beer Powders. Fine powder of Jamaica ginger, 4 or 5 drachms; bicarbonate of soda, 3½ ounces; refined sugar in powder, 14 ounces; essence of lemon, 30 drops; mix, and divide into 5 dozen powders. (Or 4 to 5 grains of ginger, 28 of bicarbonate of soda, 112 of sugar, and ½ drop of essence of lemon, in each powder.) In the other powder put 32 grains of tartaric acid; or 35 grains if a more decidedly acidulated beverage is required. Or from 30 to 33 grains of citric acid.

903. Spruce Beer Powders. In each blue paper put 5 scruples of powdered sugar, 28 grains of bicarbonate of soda, and 10 grains essence of spruce. In each white paper 30 grains of tartaric acid.

904. Sherbet. Take 8 ounces carbonate of soda, 6 ounces tartaric acid, 2 pounds loaf sugar (finely powdered), 3 drachms essence of lemon. Let the powders be very dry. Mix them intimately, and keep them for use in a wide-mouthed bottle, closely corked. Put 2 good-sized tea-spoonfuls into a tumbler; pour in ½ pint of cold water, stir briskly, and drink off.

905. Raspberry Shrub. 1 quart vinegar, 3 quarts ripe raspberries. After standing a day, strain it, adding to each pint a pound of sugar, and skim it clear, while boiling about half an hour. Put a wine-glass of brandy to each pint of the shrub, when cool. Two spoonfuls of this, mixed with a tumbler of water, is an excellent drink in warm weather and in fevers.

906. Aerated or Effervescing Lemonade. This may be made by putting into each bottle (soda water bottle) 1 ounce or 1½ ounces syrup of lemons, and filling it up with simple aerated water from the machine. (The syrup is made by dissolving 30 ounces lump sugar in 16 ounces of fresh lemon juice, by a gentle heat. It may be aromatized by adding 30 or 40 drops of essence of lemon to the sugar; or by rubbing part of the sugar on the peel of 2 lemons; or by adding to the syrup an ounce of a strong tincture of fresh lemon peel, or of the distilled spirit of the same.)

907. Effervescing Lemonade, without a Machine. Put into each bottle 2 drachms of sugar, 2 drops of essence of lemon, ½ drachm bicarbonate of potash, and water to fill the bottle; then drop in 35 or 40 grains of citric or tartaric acid in crystals, and cork immediately, placing the bottles in a cool place, or preferably, in iced water.

908. Plain Lemonade in Powder. (For ten gallons.) ½ pound tartaric acid in powder, 16 pounds sugar in powder, 1½ drachms oil of lemons. Rub and mix well. 1 ounce of this powder makes ½ pint of lemonade.

909. To Make Superior Lemonade. Take the rind of 2 lemons, juice of 3 large lemons, ½ pound loaf sugar, 1 quart boiling water. Rub some of the sugar, in lumps, on two of the lemons until they have imbibed all the oil from them, and put it with the remainder of the sugar into a jug; add the lemon juice (but no pips), and pour over the whole a quart boiling water. When the sugar is dissolved, strain the lemonade through a piece of muslin, and, when cool, it will be ready for use. The lemonade will be much improved by having the white of an egg beaten up with it.

910. To Make Orangeade. Take of dilute sulphuric acid, concentrated infusion of orange peel, each 12 drachms; syrup of orange peel, 5 fluid ounces. This quantity is added to 2 imperial gallons of water. A large wine-glassful is taken for a draught, mixed with more or less water, according to taste. This refreshing drink not only assuages the thirst, but has, moreover, strong antiseptic and anti-diarrhœa properties.

911. Imitation Lemon Juice. This is an excellent substitute for lemon juice, and keeps well in a cool place. Dissolve 1¼ ounces citric acid, 45 grains carbonate of potassa, and 2½ ounces white sugar in 1 pint cold water; add the yellow peel of a lemon, and, in 24 hours, strain through muslin or a hair sieve. Instead of the lemon peel, 15 or 16 drops of oil of lemon may be used to flavor.

912. Imitation Lemon Juice. Citric or tartaric acid, 2¼ ounces; gum, ½ ounce; pieces of fresh lemon peel, ¾ ounce; loaf sugar, 2 ounces; boiling water, 1 quart; macerate with occasional agitation till cold, and strain. Excellent.

913. Imitation Orange Juice. Dissolve 1 ounce citric acid and 1 drachm carbonate of potassa in 1 quart water, and digest in the solution the peel of half an orange until sufficiently flavored; then sweeten with honey or white sugar. Instead of the orange peel, 5 or 6 drops of oil of orange peel, with ½ fluid ounce tincture of orange peel, may be used.

914. To Keep Lemon Juice. Buy lemons when cheap and keep them in a cool place two or three days; roll them to make them squeeze easily. Squeeze the juice in a bowl, and strain it through muslin which will not permit a particle of the pulp to pass through. Have ready ½ and ¼ ounce phials, perfectly dry. Fill them with the juice so near the top as only to admit ½ tea-spoonful of sweet oil in each, or a little more if for larger bottles. Cork them tight, and put them in a cool dark place. When you want the juice, open such a sized bottle as you will use in a few days. Wind some clean cotton on a skewer, and dip it in, to absorb all the oil. When the oil is removed the juice will be as fine as when first bottled.

915. Portable Lemonade. Take 1 pound finely-powdered loaf sugar, 1 ounce tartaric or citric acid, and 20 drops essence of lemon. Mix, and keep very dry. 2 or 3 tea-spoonfuls of this stirred briskly in a tumbler of water will make a very pleasant glass of lemonade. If effervescent lemonade be desired, 1 ounce carbonate of soda must be added to the above.

916. Lemonade Powders. Pound and mix together ½ pound loaf sugar, 1 ounce carbonate of soda, and 3 drops oil of lemon. Divide the mixture into 16 portions, wrapped in white paper. Then take 1 ounce of tartaric acid, and divide into 16 portions, wrapping them in blue paper. Dissolve one of each kind in half a tumbler of water, mix the two solutions together, and drink while effervescing.

917. Lemon Soda Nectar. Juice of 1 lemon, ¾ tumblerful of water, powdered white sugar to taste, ½ small tea-spoonful of carbonate of soda. Strain the juice of the lemon, and add to it the water, with sufficient white sugar to sweeten the whole nicely. When well mixed, put in the soda, stir well, and drink while in an effervescing state.

918. Milk Punch. Take 1 table-spoonful white sugar, 2 table-spooonfuls water, 1 wine-glass cognac brandy, ½ wine-glass Santa Cruz rum, ⅛ tumblerful shaved ice. Fill with milk, shake the ingredients well together, and grate a little nutmeg on top.

919. Brandy Punch. Take 1 table-spoonful raspberry syrup, 2 table-spoonfuls white sugar, 1 wine-glass water, 1½ wine-glass brandy, ½ small sized lemon, 2 slices of orange, 1 piece of pineapple. Fill the tumbler with shaved ice, shake well, and dress the top with berries in season; sip through a straw.

920. Whiskey Punch. Take 1 wine-glass whiskey (Irish or Scotch), 2 wine-glasses boiling water, sugar to taste. Dissolve the sugar well with 1 wine-glass of the water, then pour in the whiskey, and add the balance of the water, sweeten to taste, and put in a small piece of lemon rind, or a thin slice of lemon.

921. Claret Punch. Take 1½ table-spoonfuls of sugar, 1 slice of lemon, 2 or 3 slices of orange. Fill the tumbler with shaved ice, and then pour in the claret, shake well, and ornament with berries in season. Place a straw in the glass.

922. Sherry Cobbler. Take 2 wine-glasses of sherry, 1 table-spoonful of sugar, 2 or 3 slices of orange. Fill a tumbler with shaved ice, shake well, and ornament with berries in season.

923. Egg Nogg. Take 1 table-spoonful of fine sugar, dissolved with 1 table-spoonful cold water; 1 egg, 1 wine-glass Cognac brandy, ½ wine-glass Santa Cruz rum, ⅛ tumblerful of milk. Fill the tumbler ¼ full with shaved ice, shake the ingredients until they are thoroughly mixed together, and grate a little nutmeg on top.

924. Bottle Cocktail. To make a delicious bottle of brandy cocktail, use the following ingredients: ⅔ brandy, ⅓ water, 1 pony-glass of Bogart's bitters, 1 wine-glass of gum syrup, ½ pony-glass of Curaçoa. Whiskey and gin cocktails, in bottles, may be made by using the above receipt, and substituting those liquors instead of brandy.

925. Brandy Smash. ½ table-spoonful of white sugar, 1 table-spoonful water, 1 wine-glass of brandy. Fill ⅔ full of shaved ice, use two sprigs of mint, the same as in the receipt for mint julep. Lay two small pieces of orange on top, and ornament with berries in season.

926. Santa Cruz Sour. 1 table-spoonful fine sugar, 1 wine-glass Santa Cruz rum, juice of ½ a lemon. Put the ingredients in a small tumbler ⅔ full of shaved ice, stir, and strain into a claret glass, and dress with thin slices of lime or lemon, and fruit in season.

927. Mulled Wine with Eggs. 1 quart of wine, 1 pint of water, 1 table-spoonful of allspice, and nutmeg to taste; boil them together a few minutes; beat up 6 eggs with sugar to your taste; pour the boiling wine on the eggs, stirring it all the time. Be careful not to pour the eggs into the wine, or they will curdle.

928. Regent Punch. 14 each lemons and oranges, the rinds only, 18⅜ drachms ground cinnamon, ⅜ drachm ground cloves, 2 drachms ground vanilla. Cut, macerate for 24 hours with 2 gallons pure Cognac, and 2 gallons pure Jamaica rum. Strain, press, and add 12 pounds of sugar, boiled with 6 gallons water; skim, and add to the syrup 2 ounces green tea; let it cool, and add the juice of 60 lemons and 14 oranges. Filter through Canton flannel.

929. Bottle Wax. Shellac, 2 pounds; resin, 4 pounds; Venice turpentine, 1½ pounds; red lead, 1½ pounds. Fuse the shellac and resin cautiously in a bright copper pan, over a clear charcoal fire. When melted add the turpentine, and lastly, mix in the red lead. Pour into moulds, or form sticks of the desired size on a warm marble plate. The gloss may be produced by polishing the sticks with a rag until they are cold.

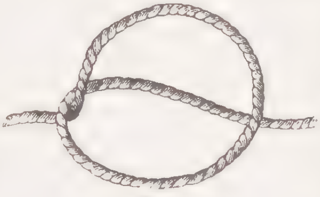


Fig. 1.

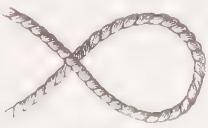


Fig. 2.

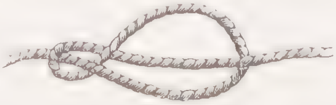


Fig. 3.

930. Corking. Little can be said with regard to the corking of bottles, beyond stating the fact that common, cheap corks, are always dear; the best corks are soft, velvety, and free from large pores; if squeezed they become more elastic and fit more closely. If good corks are used, of sufficiently large size to be extracted without the corkscrew, they may be employed many times in succession, especially if they are soaked in boiling water, which restores them to their original shape, and renews their elasticity. The most common mode of fastening down corks is with the gingerbeer knot, which is thus made. First the loop is formed as in Fig. 1, then that part of the string which passes across the loop is placed on the top of the cork, and the loop itself passed down around the neck of the bottle, and by pulling the ends of the cord is made tight beneath the rim; the ends of the string are finally brought up, and tied either in a double knot or in a bow on the top of the cork. When ginger-beer is made at home it will be found most advantageous to use the best corks, and to tie them down with a bow, when both corks and strings may be made use of repeatedly. For effervescent wines, such as champagne, gooseberry, &c., which require to be kept a longer time, and are more valuable, a securer knot is desirable, which may be made thus: A loop, as in Fig. 2, is first formed, and the lower end is then turned upwards and carried behind the loop as shown in Fig. 3; it is then pulled through the loop as in Fig. 4, and in this state is put over the neck of the bottle; the part *a* being on one side, and the two parts of the loop on the other; on pulling the two ends the whole becomes tight round the neck, and the ends, which should be quite opposite, are to be brought up over the cork, twice twisted, as in Fig. 5, and then tied in a single knot.

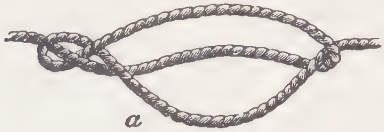
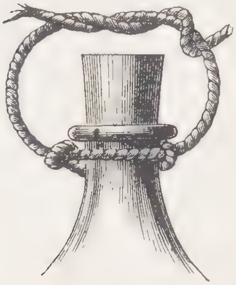


Fig. 4



Fig, 5.

931. Distillation of Whiskey and New England Rum. The process of distillation commences with the fermentation of grain or molasses by the presence of yeast, and this is called mashing, or preparing the mash. Strictly speaking, indeed, the spirits are not produced by distillation: that is done by the previous step of fermentation, and distillation merely separates the spirits from the mixture in which they already exist. The object of fermentation is to convert the starchy principle of the grain into sugar, or to saccharify it. After being agitated for 2 or 3 hours, the saccharine infusion, called wort, is drawn off from the grains and cooled. To this wort is now added a certain quantity of yeast or leaven, which induces the vinous fermentation, and resolves the saccharine matter into alcohol and carbonic acid, accompanied by a rise of temperature. The alcoholic mixture which results is called the wash, and is now ready for distillation.

932. How to Prepare Yeast for Rye Whiskey or New England Rum. To prepare yeast for 80 gallons mash, take 2 pounds of wheat meal and dilute it with sufficient warm water to make a thin paste. Then boil 2 ounces of hops in a quart of water, and when cold take out the hops and throw them away. Then dilute 1 quart of malt in a quart of water. Mix, cold, the hop water, paste and malt well together, and add half a pound of leaven. Cover the jar containing the mixture with a piece of cloth, and keep it 3 or 4 hours in some warm place until it rises. The fermentation will be perfect after the whole has arisen and then sunk down. Then add 2 gallons of the mash, stir the whole, mix it with 80 gallons of the mash, and begin the fermentation. This receipt is the very best for rye whiskey.

933. To Prepare Yeast for New England Rum. To 80 gallons mash, add 1 gallon brewers' yeast and ½ pound carbonate of ammonia dissolved in a pint of water. Stir well, and begin the fermentation. Good for New England rum.

934. To Prepare Yeast for Rye Whiskey. To 80 gallons of mash, add 1 gallon yeast, 5 quarts of malt, and 1 pound of molasses. Dilute the malt with 2 quarts of water, and add the molasses. Keep the whole in a warm place until it rises, as described in No. 931. Add the yeast to the mash and stir; afterwards add the molasses and malt and stir again. Then begin the fermentation. Good for rye whiskey.

935. How to Prepare Mash for New England Rum. For a still by steam or fire. To prepare 80 gallons mash, reduce the molasses 18 degrees by the saccharometer, add yeast No. 932, and stir well. Let it ferment at a temperature of 75° Fahrenheit, until the mash is reduced to 0. But as it is very difficult to get such a reduction, the operator may begin to distill when the mash marks 2 or 3 degrees by the saccharometer. Charge three-fourths of the still, and begin distilling.

936. How to Prepare Mash for Rye Whiskey. For a still by steam or fire. To prepare 80 gallons mash, grind the rye into coarse powder, then charge the fermenting tubs in the proportion of 110 pounds of rye to 80 gallons of water, and mix yeast No. 931 or 933. Let it ferment at a temperature of 75° or 80° Fahr., until the fermentation is completed. The fermentation will be perfect after the mash rises and sinks. When this is done, charge three-fourths of the still and begin distilling. In preparing the mash, the operator may use all rye, as directed above—this makes the best quality of whiskey—or use three-fifths rye and two-fifths corn, or three-fifths corn and two-fifths rye.

937. Distillation with or without a Heater. Distillers usually employ a heater to hasten the process of distillation. When the heater is employed, the mash passes from the fermenting tubs into the heater. During the time occupied in distilling over the charge of the still, it is necessary to keep a heat of 125 degrees in the heater. The mash passes directly from the heater into the still by means of a pipe or gutter, according to the general arrangement of the apparatus. Distill until the spirit which runs from the worm marks 10 degrees below proof. This first run is called high wine. Then remove the receiver that contains the high wine, and substitute another. Continue to distill until the low wine ceases to blaze when it is thrown in the fire. Whenever this occurs, stop the operation, and keep the low wine for the next distillation. Then clean the still and charge it with fresh mash. When the operator does not employ the heater, the mash passes from the fermenting tubs immediately into the still. No uniform disposition is necessary for the fermenting tubs or heater; all depends upon the general arrangement of the apparatus. The distiller need not be informed that the apparatus must be arranged so as to save labor. If the mash tubs are above the still, connect them by a gutter or pipe; if on a level with the still, employ a hand pump.

938. How to Pack a Rectifying Tub. To rectify from 10 below proof to 50 above proof. 30 bushels of maple charcoal are required for a tub seven feet high and four feet in diameter; a tub of this size will give a clear bed of 14 inches. At two inches from the bottom of the tub place a false bottom perforated with ½-inch holes, and cover this bottom with sailcloth or blanket. Then pack in the charcoal regularly and very tightly with a wooden pestle. Great attention should be given to this part of the operation, in order to prevent the occurrence of holes or crevices in the charcoal during the process of filtration. Pack the sides of the tub thoroughly. Cover the charcoal with sailcloth, place laths over the cloth, and use heavy stones to keep the charcoal down.

Perfumery.

The receipts in this department embrace a great variety of odorous essences, extracts, tinctures, oils, pomades, cosmetics, dentifrices, and other articles of the toilet, and are all derived from the latest and best authorities.

940. How to Prepare Essences and Perfumed Spirits. The scented spirits of the perfumer are merely alcoholic solutions of the aromatic and odorous principles of the substances they represent, obtained in one or other of the following ways:—By simply adding essential oil or other odoriferous matter to the spirit, and agitating them together until solution is complete. Occasionally the resulting alcoholic solution is distilled. By macerating or digesting the ingredients (previously bruised or pulverized) in the spirit, with frequent agitation, for a few days, when the resulting tincture is either decanted and filtered (if necessary), or the whole is thrown into a still, and submitted to distillation by a gentle heat. In the former case, the spirit retained in the pores of the solid ingredients, and which, consequently, cannot be drawn off, is obtained by powerful pressure. (*See Nos.* 39 and 40.) By digesting the spirit, with frequent agitation on highly scented pomade or oil, in a close vessel, at a gentle heat for some hours, and the next day decanting the perfumed spirit. (*See No.* 40.) Distillation is only applicable to substances of which the fragrant principles are volatile, and readily pass over with the spirit during the process. Thus, flowers, flowering tops, herbs, seeds, &c., may, in general, be so treated; but not musk, ambergris, vanilla, and a few other substances, of which the odor is of a more fixed nature. (*See No.* 13.) In proceeding by distillation, one of the first points to be attended to is, to see that the still, condensing-worm, or refrigerator, and the receiver, be perfectly clean and sweet, and absolutely free from the odor of any previous distillation. The lute employed to secure the still-head or capital to the still must also be of a simple character, incapable of conveying any taint to the hot vapor that comes in contact with it. (Linseed-meal or equal weights of linseed-meal and whiting, made into a stiff paste or dough with water, is a good lute for the purpose. Sweet almond-cake meal is still better.) The most convenient and manageable source of heat is high-pressure steam supplied from an adjacent boiler, the body of the still being enclosed in a steam-jacket for the purpose. A water-bath, the boiling-point of which should be raised by the addition of about ¼ its weight of common salt, comes next in point of convenience and effect. When the still is exposed to the heat of a naked fire, or that of dry flues, a little water must be put into it along with the spirit and other ingredients, to prevent empyreuma; and the greatest care must be taken to stop the process, and to remove the receiver, as soon as the proper quantity of distillate is obtained. If this be neglected, the odor of the whole may be vitiated. Moderately rapid distillation is favorable to the odor of the product, as is also the elevation of the boiling-point in the liquid operated on. Spirit distilled from aromatics decreases in odor with the boiling-point of the ingredients in the still. To raise the latter, the addition of 1 to 1½ pounds of common salt per gallon is often advantageously made. (*See Nos.* 5, 6 and 7.) By one or other of the above methods, or a combination of them, are, in general, prepared all the "eaux," "esprits," and "extraits," of the perfumers. As a rule, extraits and essences are preferred to eaux and esprits as the basis of good perfumery, when the color is not objectionable. Whatever process is adopted, the utmost care must be taken in the selection of the spirit used. Only spirit that is absolutely pure, flavorless, and scentless, must be employed, if we desire the product to be of fine quality. Malt-spirit or corn-spirit contaminated, even in the very slightest degree, with fusel-oil or corn-oil, or a whiskey-odor, is utterly unfit for the purpose. So also the refined methylated spirit now so commonly and fraudulently sold as spirit of wine. The extreme purity of the spirit employed by the French manufacturing perfumers —it being actually spirit of wine, and not merely so in name—is one of the reasons why their odoriferous spirits are so much superior to those of the American houses. Great care must also be taken in the selection of the essential oils intended to be employed in making perfumed spirits. These should be pure or genuine, and should be pale and recent, or of the last season's distillation. If they be old, or have been much exposed to the air, they will contain more or less resin, and their alcoholic solution will be defective in fragrance, and be liable to permanently stain delicate articles of clothing to which it may be applied. The strength of the spirit used for concentrated essences, as a rule, should not be less than 90 per cent., or of the specific gravity .8332. A few require a spirit of even greater strength than this. The first quality of extraits, particularly those prepared from pomades and oils, and many of the eaux and esprits, also require 90 per cent. spirit. The strength of the spirit for the others, and for second qualities (commonly sold as the best in the stores), must be fully 75 per cent., or of the specific gravity .8765; that of the third quality fully 70 per cent., or specific gravity .8892; and that of the fourth quality fully proof, or specific gravity .920. The last is the lowest quality, and the weakest of any kind made by respectable perfumers; but the double distilled lavender-water, eau de Cologne, and other scents, vended in little showy bottles, by the druggists, and in fancy-stores, are commonly even much weaker than this, being often under proof. (*See No.* 1435.) The capacity of spirit, at this strength, of dissolving essential oil and other odorous matter is, however, very little. The solvent power of spirit decreases with its strength, but much more rapidly. (*Cooley.*)

941. Essences. The term *essence* is generally very loosely applied to a preparation of almost any kind, that is supposed to contain in a high degree the essential or distinctive principle or quality of some substance. Thus, the essential or volatile oils obtained from vegetable substances by distillation; concentrated infusions, decoctions, aqueous solutions, and tinctures, are all often erroneously termed essences.

In perfumery the word "essence" is applied only to a solution of an essential oil in deodorized alcohol, in the proportion, usually, of 2 drachms to 2 ounces of the essential oil to 1 quart of rectified spirits. Sometimes an essence, using the term in its correct sense, is distilled, with the addition of a little water; it is then called *distilled aromatic spirits.*

942. Essences of Flowers. The essences of those flowers which are not separately given in this work, may be made by one or other of the following general formulæ. Take of essential oil (of the respective flowers), 1 ounce avoirdupois, and rectified spirit 90 per cent. 1 pint (Imperial); dissolve as directed for "Essence of Almonds." Or, take of the (respective) flowers, 3 to 5 pounds; proof spirit, 2 gallons; digest for a few days, and then draw over, by distillation, 1 gallon of essence. For those flowers that are not strongly fragrant, the product may be distilled a second and a third time, or even oftener, from fresh flowers, as noticed under "Essence of Roses." The products obtained by distillation are always colorless; and hence flowers rich in color may, in general, be advantageously so treated. The flowers should be selected when in their state of highest fragrance; and should be picked to pieces, or crushed or bruised, as their nature may indicate. With many, the last is facilitated by the addition of some clean sand or common salt. Or, proceed in the way described under "Essence of Tuberose." This applies to most of those flowers that contain little fragrant oil, and of which the odor is extremely delicate. A small quantity of some other odorous essence or volatile oil is commonly added to the simple essences of flowers, at will, to enrich or modify the fragrance, each manufacturer usually pursuing his own taste in the matter. In some cases, spirit is impregnated with a combination of essential oils and other odorous substances, so as to produce, artificially, an odor resembling or approaching that of the particular flowers after which the products are named; although there may be none of the respective flowers employed in their preparation. This is particularly the case with flowers of which the odorous principle is difficult or troublesome to extract, or which possess very little of it. So also of the essences of many flowers having strange or attractive names, and no true fragrance. Hence arises the almost endless variety of fragrant essences, esprits, and similar preparations, vended by the perfumers of the present day, numbers of which are mere artificial combinations of other perfumes. (*Cooley.*)

943. Essence of Almonds; Essence of Bitter Almonds; Essence of Peach-kernels; Almond Flavor. Take of essential oil of almonds, 1 fluid ounce; and rectified spirit (90 per cent.), 19 fluid ounces; mix, and agitate or shake them together until united.

944. Essence of Roses. Take of pure otto of roses 1¼ drachms (Troy); and alcohol (96 per cent.) 1 pint (Imperial); mix, place the bottle in a vessel of warm water until its contents acquire the temperature of about 85° Fahr., then cork it close, and agitate it smartly until the whole is quite cold. Very fine.

945. Extra Essence of Roses. Take of petals of roses (fresh) 3 pounds avoirdupois; and rectified spirit (90 per cent.) 5 Imperial quarts; digest the petals (picked to pieces) in the spirit for 24 hours, then distill to dryness by the heat of a water-bath. Digest the distillate (product of distillation) on a fresh quantity of rose-petals, and re-distill, as before; and repeat the whole process of maceration and distillation a third, fourth, fifth, and sixth time, or oftener, the last time observing to conduct the distillation rapidly, and to draw over only 1 gallon, which is the essence. Delicately and delightfully fragrant. It improves by age. The product of each of the above receipts is very superior; but that of the last has a peculiar delicacy of flavor, which distinguishes it from those prepared from the otto. Some makers add to each pint of the former 20 or 30 drops each oil of bergamot and neroli, and 15 or 20 drops essence of musk; but the product of the last formula is scarcely improved by any addition, unless it be a very little neroli or essence d'ambrette, or both, as the case may indicate. The best rose leaves to use are those of the rosa centifolia (cabbage-rose, damask-rose), or rosa sempervirens (musk-rose), or mixtures of them.

946. Essence of Rondeletia; Extrait de Rondeletia. Various formulæ are current for this exquisite perfume, of which scarcely any produce an article approaching in excellence the proprietary one. The following is an exception: Take of oil of lavender (Mitcham), ¾ ounce avoirdupois; oil of cloves (finest), 5 drachms avoirdupois: oil of bergamot, 4 drachms; ½ drachm each of the finest essence of ambergris and musk; rectified spirit (strongest), ¾ Imperial pint; agitate them together until completely united. Some persons add ½ drachm of neroli, or of oil of verbena (Indian lemon-grass), with or without 10 or 12 drops of otto of roses. Very fine.

947. Curious Essence. Take of otto of roses 2 drachms; oil of rose-geranium, 1 drachm; essence of musk, 3 Imperial fluid drachms; essence of ambergris, 1 Imperial fluid drachm; rectified spirit (warm), 1 pint; mix, closely cork the bottle, and agitate frequently until cold. A powerful, durable, and very agreeable perfume.

948. Essence de Frangipane; Extrait de Frangipane; Frangipanni. Take of neroli, 2 Imperial fluid drachms; essence royale, 3 fluid drachms; civet (powdered), 10 grains avoirdupois; oil of lavender, oil of cloves, oil of rhodium, of each, 5 or 6 drops; rectified spirit, 3½ to 4½ fluid ounces; digest a week, and then decant the clear portion. Powerful, durable, and pleasant.

949. Essence of Violets; Essence of Orris; Factitious. Take of Florentine orris-root (coarsely powdered), 1½ pounds avoirdupois; rectified spirit, 1 Imperial quart; proceed by percolation or the method of displacement, so as to obtain 1 quart of essence; or by digestion for two weeks, followed by powerful pressure in a tincture-press. The former is the best and most economical method. This forms the best essence of violets of the wholesale druggists. It may be, but is rarely, distilled. (*See No.* 954.)

950. Essence of Cologne; Cologne-Essence; Concentrated Eau de Cologne. This is prepared from the same odorous ingredients as "Eau de Cologne," but taking 7 or 8 times the quantity, and using alcohol or the strongest rectified spirit, without which a permanent solution of the whole of them cannot be formed. Used as a condensed and convenient substitute for ordinary "Eau de Cologne" by travelers, being less bulky. It is also kept in stock by druggists and perfumers, to enable them to prepare that article extemporaneously, by simply diluting it with 8 times its bulk of spirit of the appropriate strength.

951. Essence of Orange; Essence of Orange-peel. Oil of orange-peel is popularly so called. The alcoholic essence is made from this oil like essence of almonds. (*See No.* 943.)

952. Essence of Pimento; Essence of Allspice. Prepared from oil of pimento, as essence of almonds. Sometimes used in compound perfumes and cosmetics, and for toothache; but chiefly as a flavoring essence.

953. Essence of Pineapple. From pineapple oil (butyric ether), as the last. Sometimes taken on sugar, by smokers; but chiefly used by confectioners, liqueur manufacturers, &c. (*See No.* 1060.)

954. Essence of Tuberose. The flowers are placed in alternate layers with sheep's or cotton wool impregnated with the purest oil of ben or of olives, in an earthen vessel, closely covered, and kept for 12 hours in a water bath; the flowers are then removed and fresh ones substituted, and this is repeated until the oil is sufficiently scented. The wool or cotton is then mixed with the purest spirit of wine, and distilled in a water bath; or, it is first digested in a well closed vessel for several days in a warm situation, with frequent agitation. A similar plan is followed for the preparation of the essences of jasmine, violets, &c. (*See No.* 1349.)

955. Essence of Lemons. From oil of lemon, as essence of almonds. (*See No.* 943.) For this purpose the oil should have been recently expressed, and preserved from the air. A dash of essence of musk improves it as a perfume, but not as a flavoring essence. Oil of lemon is popularly called essence of lemons.

956. Concentrated Essence of Musk. Take of grain-musk (Tonquin or Chinese), 1 ounce avoirdupois; boiling distilled water, ½ Imperial pint; digest them together in a close vessel, with frequent agitation, until quite cold, then add 3½ pints rectified spirit (95 per cent.), ½ fluid ounce liquor of ammonia (.880–.885 specific gravity), and, having closely corked or stopped the vessel and securely tied it over with bladder, digest the whole for 1 or 2 months, with frequent agitation, in a room exposed to the sun, in summer, or in an equally warm situation in winter. Lastly, after repose, decant the clear portion, and, if necessary, filter it. A little essence of ambergris is commonly added to the filtrate, or, when this is not done, 1 to 2 drachms of ambergris are put into the vessel before closing it, and after adding the spirit. Very fine. The residuum is treated with fresh spirit for an inferior quality.

957. Fine Essence of Musk. Take ¼ ounce finest grain-musk, civet and ambergris each 1 drachm, strongest essence d'ambrette, ½ pint. Instead of the ambergris, 1 to 1½ fluid ounces of essence of ambergris may be added after decantation. The quantity of civet ordered should on no account be exceeded. This produces the finest quality of the Paris houses.

958. Common Essence of Musk. Take ¼ ounce (avoidupois) grain-musk, 1 quart (Imperial) rectified spirit (95 per cent.), and 2 fluid ounces finest essence of ambergris; digest, &c., as before. Excellent; but greatly inferior to the others. Essence of musk is an agreeable and powerful perfume, and is greatly esteemed in the fashionable world. Its odor is so durable that articles scented with it will retain the fragrance for years. The product of each of the above is of very fine quality; but that of No. 957 is the very finest that is made, and such as is seldom sold, except by the high-class perfumers, who obtain for it a very high price. It is powerfully and deliciously fragrant.

959. Best Way to Prepare the Essence of Musk and Ambergris. The best vessel for preparing essence of musk, as well as of ambergris, is a strong tin-bottle with a nicely rounded mouth and neck. Great care should be taken to cork it perfectly close, and, after this is done, to tie it over securely with wet bladder. The bottle should not be set in the full sunshine, but only in a position warmed by it; and in no case should the digestion be of shorter duration than three or four weeks, as otherwise much fragrant matter will escape solution. The addition of ½ to 1 fluid drachm, per pint, of liquor of ammonia, or of liquor of potassa (the first is greatly preferable), increases the solvent power of the spirit and vastly increases the fragrance of the essence. A few grains of salt of tartar (carbonate of potash) are sometimes added with the same intention; but this addition is objectionable, as it does not effect the object in view, whilst it occasions partial decomposition of the mixture. To facilitate the action of the menstruum, and to make the most of the ingredients, it is best to rub down the musk, &c., with a little powdered glass, sand, or lump sugar, as noticed under "Essence of Ambergris." Filtration and exposure to the air should, if possible, be avoided.

960. Essence Royale. Take of ambergris, 40 grains avoirdupois; grain-musk (pure), 20 grains; civet and carbonate of potassa, of each 10 grains; oil of cinnamon, 6 drops; oil of rhodium and otto of roses, of each 4 drops; rectified spirit, 4 Imperial fluid ounces; digest, with agitation, for 10 or 12 days, or longer. Very fragrant. The above is a celebrated receipt, but we think it would be improved by substituting 12 drops liquor of ammonia for the carbonate of potassa. (*See last receipt.*)

961. Essence of Neroli; Essence of Orange Blossoms; or Essence de Fléurs d'Oranges. Dissolve ½ ounce avoirdupois pure neroli in rectified spirit, 1 Imperial pint. An ounce of essence of jasmine, jonquille, or violets, is often added. A delicate and delicious perfume.

962. Essence of Storax (or Styrax); Extract of Storax. Take 1 ounce avoirdupois finest genuine liquid storax and ½ Imperial pint rectified spirit; digest, with agitation, for a week, and then decant the clear portion.

963. Essence of Ambergris; or Concentrated Tincture of Ambergris. Take 10 drachms avoirdupois 95 per cent. ambergris and 1 Imperial pint rectified spirit, put them into a strong bottle or tin can, secure the mouth perfectly and very firmly, and keep the vessel in a room exposed to the heat of the sun, or equally warm, for a month or two, observing to briskly agitate it daily during the whole time. Lastly, after repose, decant the clear portion, and, if necessary, filter it rapidly through soft blotting paper. Very fine. It forms the strongest and finest simple essence of ambergris of the Paris houses. (*See No.* 959.) The common practice in making the essence is to cut the ambergris up small before digesting it; but a much better plan is to rub down both the ambergris and musk with a little powdered glass, clean silicious sand, or dry lump-sugar, observing afterwards to rinse the mortar out well two or three times, with portions of the spirit, so that nothing may be lost. A second quality may be made by employing half the quantity of ambergris to the same amount of spirit.

964. Essence of Ambergris. Ambergris 10 drachms avoirdupois; grain musk (Tonquin or Chinese pure), 3 drachms; rectified spirit, 1 quart. Proceed as in the last receipt. The products of the above two receipts form a delightful perfume highly esteemed in the fashionable world. A very small quantity of any one of them added to eau de Cologne, lavender-water, tooth-powder, hair-powder, pomades, wash-balls, &c., communicates a delicious fragrance. A few drops added to sweet-scented spirits, liqueurs, wines, &c., improve their flavor and aroma. 1 or 1½ fluid drachms added to a hogshead of claret, imparts a flavor and bouquet to the wine which is regarded by many as delicious.

965. Fine Essence of Vanilla. Take ½ pound avoirdupois finest vanilla, and rectified spirit, 1 Imperial quart; proceed as for essence of musk. (*See No.* 959.) Lastly, press and decant or filter. Very superior. It forms the best quality vended by the wholesale druggists, and is sold at exorbitant prices. This, as well as the preceding, is chiefly used for flavoring, and as an ingredient in compound perfumes and cosmetics. Essence of vanilla is a favorite and useful addition to tooth-cosmetics, pomades, &c. In preparing it, the vanilla, &c., should be cut small with a sharp knife; or what is better, rubbed down with a little powdered glass, sand, or lump-sugar.

966. Essence of Patchouli; Essence de Patchoulie; or Essence de Pouchapat. Take 3 pounds avoirdupois Indian patchouli (leaves or foliaceous tops), and rectified spirit 9 Imperial pints; digest for a week in a close vessel, add ½ ounce oil of lavender (Mitcham) and promote solution by agitation. Next throw the whole into a still, and further add 1 gallon water and 2 or 3 pounds common salt. Agitate the whole briskly together, lute on the still-head, and distill over (rapidly) 1 gallon. To the distillate add ½ fluid ounce finest essence of musk; and after 10 days' repose, bottle it. A very fashionable perfume, particularly for personal use.

967. Common Essence of Patchouli. 1¼ ounces otto of patchouli, ¼ ounce otto of rose, and 1 gallon rectified spirit.

968. Essence d'Ambrette; or Essence of Musk-seed. Take 1¼ pounds avoirdupois finest musk-seed; grind it in a clean pepper-mill, and digest it for 3 or 4 weeks in 3 pints Imperial rectified spirit; the vessel being closely stopped or corked, and kept in a warm room all the time. Lastly decant, press and filter.

969. Essence of Bergamot. The popular name of oil of bergamot. A spirituous essence may be made in a similar way to that of almonds. (*See No.* 943.)

970. Essence of Cassia. From oil of cassia, as essence of almonds. (*See No.* 943.) Uses, &c., the same.

971. Essence of Cinnamon. From oil of cinnamon, as essence of almonds. (*See No.* 943.) Essence of cassia is commonly and fraudulently sold for it.

972. Essence of Civet. Take 1 ounce (avoirdupois) civet cut very small, and 1 pint (Imperial) rectified spirit; proceed as for essence of ambergris or musk. Its odor is only agreeable when faint and combined with that of other substances, which it sustains and increases. It is hence seldom or never used alone.

973. Essence of Lavender. Take 1 ounce avoirdupois oil of lavender (Mitcham) and ½ Imperial pint strongest rectified spirit; mix with agitation; a few drops of the essences of musk and ambergris being added at will. Very fine.

974. To Extract the Essence from any Flower. Take any flowers you choose; place a layer in a clean earthen pot, and over them a layer of fine salt. Repeat the process until the pot is filled, cover closely, and place in the cellar. Forty days afterwards, strain the essence from the whole through a crape by pressure. Put the essence thus expressed in a clear bottle, and expose for six weeks in the rays of the sun and evening dew to purify. One drop of this essence will communicate its odor to a pint of water.

975. To Make Attar, or Otto of Roses. Gather the flowers of the hundred-leaved rose (rosa centifolia), put them in a large jar or cask, with just sufficient water to cover them, then put the vessel to stand in the sun, and in about a week afterwards the attar—a butyraceous oil—will form a scum on the surface, which should be removed by the aid of a piece of cotton.

Cologne Water and Perfumed Spirits.

In preparing eau de Cologne, it is essential that the spirit be of the purest description, both tasteless and scentless, and that the oils be not only genuine, but recently distilled; as old oils, especially if they have been exposed to the air, are less odorous, and contain a considerable quantity of resin and camphor, which would prove injurious. French spirit of. 90 per cent. should be used in the manufacture of eau de Cologne, and when a weaker spirit is employed, the essential oils must be dissolved in a small quantity of 90 or 95 per cent. spirit. Should the mixture afterwards prove turbid, filter it through paper with a little carbonate of magnesia. (*See Nos.* 1080 and 1081.) To produce an article of the finest quality, distillation should be had recourse to; but a very excellent eau de Cologne may be produced by simple solution or maceration of the ingredients in the spirit, provided all the essences be new, pale-colored, and pure.

The mass of the eau de Cologne prepared in America, some of which possesses the most delicate fragrance, and is nearly equal to the best imported, is made without distillation.

977. Piesse's Best Quality Eau de Cologne. Mix with agitation 3 ounces attar of neroli pétale; 1 ounce attar of neroli bigarade; 2 ounces attar of rosemary; 5 ounces attar of orange zest; 5 ounces attar of citron zest; and 2 ounces attar of bergamot, with 6 gallons 95 per cent. grape spirit. Let it stand perfectly quiet for a few days. Although very fine eau de Cologne is often made by merely mixing the ingredients, it is better first to mix all the citrine attars with spirit, then distill the mixture, and afterwards add the rosemary and nerolies. This method is adopted by the most popular house in Cologne.

978. Eau de Cologne. To 3 pints alcohol of 95° add 12½ drachms oil of lemon, 1¼ drachms oil of orange, 2½ drachms oil of cedrat, 1¼ drachms oil of vervain, 2½ drachms oil of bergamot, 2½ drachms oil of mint, 5 drachms oil of lavender, 1¼ drachms oil of white thyme, 2 drachms oil of Portugal, 1¼ drachms oil of rosemary, 8 ounces tincture of ambretta, and 1 pound eau de melisse; (*eau des carmes*); mix well in a bottle, and after standing six hours add 2½ drachms tincture of ambergris; then filter until clear. This is greatly improved by distilling.

979. Eau de Cologne—*Extra.*—Put 1 quart 95 per cent. alcohol into a bottle; add to it 9 drachms oil of cedrat, 2 drachms oil of thyme, 6 drachms each oil of bergamot and oil of lemon, 4 drachms oil of Portugal, 2 drachms each oil of neroli, oil of vervain and oil of rosemary, 2½ drachms oil of mint, 2 pints eau de melisse and 24 drops tincture of musk; mix thoroughly, and after standing for 12 hours, filter till clear.

980. Durockereau's Cologne Water. To 7 quarts French tasteless alcohol, add 11 drachms essence of Portugal, 13 drachms essence of bergamot, 1 ounce essence of lemon, 10 drachms essence of neroli, 1 ounce essence of rosemary, 1 ounce essence of lavender, 14 drachms rose water, 13 drachms jasmin water, 15 drachms orange-flower water. Mix the whole together, let it stand 24 hours, and distill over a water-bath.

981. Gouffe's Eau de Cologne. Take ½ ounce each essences of lemon, bergamot, and citron; ¼ ounce essence of rosemary; ⅛ ounce essence of neroli. Infuse for 8 days in 1 quart 95 per cent. alcohol. Filter, and bottle for use.

982. Farina's Eau de Cologne. Take of angelica-root, 10 grains; camphor, 15 grains; cassia-lignea, cloves, mace, nutmegs, wormwood tops, of each 20 grains; calamus aromaticus, sage, thyme, of each ½ drachm (Troy); orange flowers, 1 drachm (Troy); lavender flowers, 1½ drachms (Troy); rose petals, violets of each, 3 drachms (Troy); balm-mint and spear-mint of each 1 ounce (Troy); 2 sliced lemons; 2 sliced oranges, and 5 gallons rectified Cologne spirits. Bruise or slice the solids, and digest them in the spirit, with frequent agitation, for 2 or 3 days, then distill off 3 gallons. To this add, of oil of bergamot, *essential* oil of jasmin, 1 fluid ounce each; oil of balm-mint, oil of cedrat, oil of lavender, oil of lemon, 1 fluid drachm each; pure neroli and oil of anthos-seed, of each 20 drops. Agitate until solution is complete, and the next day, if necessary, filter. This formula, many years since, was confidentially given by the celebrated original Jean Maria Farina, who lived opposite the Jülichs Platz, in Cologne, to a professional gentleman, now deceased, with a solemn assurance that it was the one used by the former in his laboratory. After keeping the secret some years, this gentleman disclosed it. It seems unnecessarily complicated. Some of the articles, as the herbs wormwood and mint, are either useless or better omitted. The version given above differs from the original simply in being intended for only 5 gallons instead of twelve times the quantity. Dr. Cooley says he personally tried it, and found the quality of the product splendid.

983. Parrish's Best Cologne Water. Mix together 2 fluid ounces oil of bergamot, 2 fluid drachms oil of neroli, ½ fluid ounce oil of jasmin, 2 fluid drachms oil of garden lavender, 1 minim oil of cinnamon, 3 fluid ounces benzoated tincture, ½ fluid ounce oil of musk, 1 gallon deodorized alcohol, and 2 pints rose-water. The mixture should stand a long time before filtering for use.

984. Parrish's Common Cologne Water. A much cheaper preparation than the foregoing can be made by mixing 1½ fluid ounces oil of lavender, ½ fluid ounce oil of rosemary, 1 fluid ounce oil of lemon, and 20 drops oil of cinnamon, with 1 gallon alcohol.

985. Genuine Cologne Water. The following formula was published by one of the Farinas in the journal of the North German Apothecaries' Association. Dissolve 2 ounces by weight purified benzoin, 4 ounces oil of lavender, and 2 ounces oil of rosemary, in 9 gallons 95 per cent. fine Cologne spirits. To this solution add successively, 10⅖ ounces each of the oils of neroli, neroli petit-grain, and lemon; 20⅘ ounces each of the oils of sweet orange peel, limes, and bergamot; together with tincture of rose-geranium flowers, sufficient to suit the taste. Macerate for some weeks, then fill into flasks.

986. Fine Cologne Water. Take of pure 95 per cent. Cologne spirits, 6 gallons; oil of neroli, 4 ounces; oil of rosemary, 2 ounces; oil of orange, 5 ounces; oil of citron, 5 ounces; oil of bergamot, 2 ounces; mix with agitation; then allow it to stand for a few days perfectly quiet before bottling.

987. Cologne Water, Second Quality. Pure 95 per cent. alcohol, 6 gallons; oil of neroli, 2½ ounces; oil of rosemary, 2 ounces; oil of orange peel, 4 ounces; oil of lemon, 4 ounces; oil of bergamot, 4 ounces. Treat in the same way as the last.

988. Eau des Carmes; Eau de Melisse; Compound Spirit of Balm. Fresh flowering balm, 24 ounces; yellow rind of lemon, cut fine, 4 ounces; cinnamon, cloves, and nutmeg (bruised), of each 2 ounces; coriander seed (bruised), 1 ounce; dried angelica root, 1 ounce; rectified spirit, 1 gallon. Macerate for 4 days, and distill in a water-bath.

989. Fine Lavender Water; or Eau de Lavande. Take 2 ounces (avoirdupois) finest oil of lavender (Mitcham), essence of musk (finest), 1 Imperial fluid ounce; essence of ambergris (finest), and oil of bergamot (recent), of each ½ ounce; rectified spirit (90 per cent., scentless), ½ gallon; mix by agitation. Very fine without distillation; but better for it, in which case the essences should be added to the distillate. Delightfully and powerfully fragrant. (*Cooley.*)

990. Smith's Lavender Water. Take ½ ounce (avoirdupois) oil of lavender (Mitcham); essence of ambergris, ¼ ounce; eau de Cologne (finest), ¼ Imperial pint; rectified spirit, ½ pint; mix by agitation. Very fragrant, and much esteemed. The ordinary lavender water is usually made with spirit at proof, or even much weaker; hence its inferior quality to that of the higher class of perfumers. 1 ounce of true English oil of lavender is all that will perfectly combine with 1 gallon of proof spirit (or 1 drachm to the pint); any excess rendering it milky or cloudy.

991. Common Lavender Water. English oil of lavender, 3 ounces; rectified spirit (90 per cent.), 1 gallon. Dissolve. Cordial, and fragrant.

992. Eau de Bouquet. Take of spirit of rosemary, essence of violets, and orange-flower water, of each 1 Imperial fluid ounce; oil of bergamot and oil of jasmin, of each 1 fluid drachm; oil of lavender and oil of verbena, of each ½ fluid drachm; eau de rose, ½ pint; rectified spirit, 1½ pints; mix. A delightful perfume. Various other similar formulæ are employed.

993. Eau de Maréchale. Take of essence of violets, 1 Imperial fluid ounce; oil of bergamot and oil of cloves, of each ¼ ounce (avoirdupois); orange-flower water, ½ pint; rectified spirit, 1 pint; mix. An agreeable and favorite perfume.

994. Eau d'Ambre Royale; Eau Royale. Take of essence of ambergris and essence of musk, of each 1 Imperial fluid drachm; eau d'Ambrette and eau de fleurs d'oranges, of each 2½ fluid ounces; rectified spirit, 5 fluid ounces; mix. Very agreeable and durable.

995. Eau d'Ambrette; or Esprit d'Ambrette. Take 1 pound (avoirdupois) grains d'Ambrette (musk-mallow seed, bruised); rectified spirit, 1 Imperial quart; water, ¾ pint; digest for 7 or 8 days, and distill off 1 quart. Very fine. Commonly sold as "Essence d'Ambrette." When used alone, a very few drops of essence of ambergris and esprit de rose improve it.

996. Fine Hungary Water. Take 2 pounds (avoirdupois) rosemary-tops (in blossom); ¼ pound sage (fresh); rectified spirit, 3 Imperial quarts; water, 1 quart; digest for 10 days, throw the whole into a still, add 1½ pounds common salt, and draw over 6 pints. To the distillate add 1 ounce bruised Jamaica ginger, digest a few days, and either decant or filter. The old plan of adding the ginger before distillation is wrong, as the aromatic principle of the root does not pass over with the vapor of alcohol.

997. Common Hungary Water. Take 1½ to 2 Imperial fluid drachms pure oil of rosemary; oil of lavender (English), ½ fluid drachm; orange-flower water ½ pint; rectified spirits, 1½ pints; mix. No. 996 is the genuine formula. This is the perfume usually sold by the perfumers. Spirit of rosemary is now commonly sold for it by the druggists.

998. Simple Perfumed Spirits—Esprits. The simple perfumed spirits (esprits) and odoriferous tinctures are principally used in making compound eaux, esprits, &c. Their common strength, per pint, is, of—

Attar of roses, ½ fluid drachm; neroli, essence de petit grain, of each 1½ to 2 fluid drachms; essential oils (ordinary), ½ fluid ounce; concentrated essences, 2 to 2½ fluid ounces. The spirit of wine employed for them should in no case be weaker than 75 per cent., and for spirit of roses (esprit de rose), it should be, at the least, 90, or else little of the attar will be dissolved. These proportions may be adopted for all the simple spirits of the perfumer for which separate formulæ are not given in this work, and even in place of those so given, at the convenience of the operator, when intended for the use just mentioned. When flowers, leaves, seeds, &c., are employed, the proportions may be 1½ to 3, or even 5 pounds to the gallon of the distillate or product, according to their nature; and, with certain flowers, the process must be repeated with fresh flowers, as often as necessary. To mature and bring out the full fragrance of distilled spirits, they should be kept for some time in a cellar, or other cool situation, previously to being used or offered for sale. The same applies, though in a less degree, to perfumed spirits prepared by the other methods.

999. Esprit de Bergamotte. Take 5 Imperial fluid drachms oil of bergamot (finest, recent); oil of rose-geranium and oil of verbena, each ½ fluid drachm; essence of ambergris, 2 fluid drachms; essence of musk, ½ fluid drachm; rectified spirit, 1 pint; mix. Very fine. For a second quality (usually called best), 1 quart of spirit (70 per cent.) is used; for a third quality, 3 to 4 pints at proof.

1000. Eau de Lavande de Millefleurs. Take 1 quart eau de lavande; oil of cloves, 1½ fluid drachms; oil of cassia and essence of ambergris, each ½ fluid drachm; mix.

1001. Esprit de Rose. The compound perfume sold under this name is commonly made as follows: Take 1 Imperial pint finest simple esprit de rose (*see No.* 998); essence of ambergris and oil of rose-geranium, each ½ fluid drachm; mix. Delicately fragrant.

1002. Esprit de Bouquet. Take 4 Imperial fluid drachms oil of lavender; oil of bergamot and oil of cloves, each 1½ fluid drachms; essence of musk and oil of verbena, each ½ fluid drachm; attar of roses, 5 to 6 drops; and rectified spirit, 1 pint; mix, and agitate frequently for a day or two. A very powerful and agreeable scent.

1003. Eau d'Héliotrope. Take essence of ambergris, coarsely powdered, ½ Imperial fluid drachm; vanilla, ½ ounce avoirdupois; orange-flower water, ½ pint; rectified spirit, 1 quart; digest for a week, and then decant or filter. 5 or 6 drops each of oil of bitter almonds and cassia are sometimes added. Used both as a cosmetic and perfume.

1004. Esprit de Jasmin Odorant. Take extrait de jasmin, and rectified spirit, each ½ Imperial pint; essence of ambergris, ½ fluid drachm; neroli (finest), 8 or 10 drops; mix. A delicate and favorite foreign scent.

1005. Millefleur Water. Very pure rectified spirit, 9 pints; balsam of Peru (genuine) and essence of cloves, each 1 ounce; essences of bergamot and musk, each 2 ounces; essences of neroli and thyme, each ¼ ounce; eau de fleurs d'oranges, 1 quart; mix well. Very fine.

1006. Honey Water (Eau de Miel). Rectified spirit, 8 pints (Imperial); oil of cloves, oil of lavender, oil of bergamot, of each ½ ounce avoirdupois; musk, 15 grains; yellow-sanders shavings, 4 ounces; digest for 8 days, and add 2 pints each of orange-flower and rose waters.

1007. Honey Water. (With Honey.) White honey, 8 ounces avoirdupois; coriander seed, 8 ounces; fresh lemon-peel, 1 ounce; cloves, ¾ ounce; nutmeg, benzoin, styrax calamita, of each 1 ounce; rose and orange-flower water, of each 4 ounces; rectified spirit, 3 Imperial pints; digest for a few days, and filter. Some receipts add 3 drachms of vanilla, and direct only ½ ounce of nutmeg, storax, and benzoin.

1008. Rose Water. The ordinary best rose-water of the stores, particularly of the wholesale druggists who deal largely in the article, is generally made as follows:—Dissolve attar of roses, 6 drachms avoirdupois, in strongest rectified spirit (hot), 1 Imperial pint; throw the solution into a 12-gallon carboy, and add 10 gallons pure distilled water, at 180° to 185° Fahr.; at once cork the carboy (at first loosely), and agitate the whole briskly (at first cautiously), until quite cold. The product is really superior to much of the trash carelessly distilled from a scanty quantity of rose-leaves, and sold as rose water. (*See Nos.* 1071 and 1079).

1009. Orange-Flower Water. The genuine imported article is one of the most delightfully fragrant of all the odoriferous distilled waters. An imitation may be made as follows:—Take of orange-flowers, 7 pounds avoirdupois; fresh thin yellow-peel of bitter oranges, 6 to 8 ounces; water, 2 Imperial gallons; macerate 24 hours, and then distill 1 gallon.

1010. Orange-Flower Water. Another method is as follows.—Orange-flowers, 12 pounds avoirdupois; water, 36 pounds; distill 24 pounds for double orange-flower water; this, with an equal quantity of distilled water, forms the single. The flowers should not be put into the still till the water nearly boils.

1011. Florida Water. Dissolve in ½ gallon 90 per cent. alcohol, 1 ounce each oil of lavender, oil of bergamot, and oil of lemon; and of oil of cloves and cinnamon 1 drachm each; add 1 gallon water, and filter.

1012. Florida Water. Oil of bergamot, 3 ounces; oil of cinnamon, 4 drachms; tincture of benzoin, 2 ounces; 75 per cent. alcohol, 1 gallon. Mix and filter. (*See No.* 976.)

1013. Fine Florida Water. Take 2 drachms each of the oils of lavender, bergamot, and lemon; 1 drachm each of tincture of turmeric and oil of neroli; 30 drops oil of balm and 10 drops oil of rose; mix the above with 2 pints deodorized alcohol. (*See No.* 976.)

1014. Tincture of Coriander. Powder coarsely 4 ounces coriander seed, and macerate for 15 days in 1 pint 95° alcohol; strain and filter.

1015. Tincture of Nutmegs. Bruise well 6 ounces nutmegs in 1½ pints 95° alcohol; let it remain for a couple of weeks, stirring occasionally; then press through a coarse cloth, and filter. Tincture of ginger, mace, and other spices are prepared by the same method.

1016. Tincture of Storax. Macerate 5 ounces storax in 3 pints 95° alcohol, until dissolved, then filter.

1017. Alcoholate of Roses. Macerate 2 pounds fresh roses in 2 quarts alcohol of 95° and 1 pint water for 12 hours; then distill by means of a water-bath. If a superior article is required, the alcoholate thus prepared may be used to macerate 2 pounds more roses, and then distilled as before.

1018. Tincture of Vanilla. Steep 2 ounces vanilla, cut into small pieces, in 1 pint alcohol, for about a month; stir frequently, and filter.

1019. Tincture of Benzoin. In 2½ quarts alcohol of 95°, macerate 8 ounces powdered benzoin until dissolved, then filter it and bottle; cork closely.

1020. Tincture of Balsam of Peru. Macerate 8 ounces liquid balsam of Peru in 3 pints 95° alcohol; when dissolved, filter.

1021. Tincture of Grain of Paradise. Macerate 4 ounces coarsely powdered grain of paradise for 15 days in 1 pint alcohol of 95°, then press through a cloth and filter.

1022. Tincture of Balsam of Tolu. Dissolve 5 ounces balsam of Tolu in 3 pints alcohol, and filter.

1023. Tincture of Cardamoms. Bruise 4 ounces cardamoms, and macerate 2 weeks in alcohol of 95°; press through a cloth and filter.

1024. Tincture of Ambergris. Powder thoroughly 1 ounce ambergris and ½ ounce sugar in a warm mortar; then dissolve ½ ounce carbonate of potash in 14 ounces alcoholate of roses, and add to it 3½ ounces tincture of musk (*see No.* 1025); macerate the whole for about 1 month, and filter.

1025. Tincture of Musk. Rub ½ ounce musk in a warm mortar with a little sugar; macerate for a month in 7 ounces alcohol containing 1 ounce each tincture of ambergris and tincture of vanilla. Filter thoroughly and then add a few drops of attar of roses.

1026. Economical Perfumes. The cheap perfumes which are offered for sale in small fancy bottles, are of the simplest kind, and from the nature of the case, made of the least expensive materials. The following are the leading mixtures, which are sold under the names deemed the most likely to prove attractive:

Mix 1 ounce essence of bergamot, or attar of santal, with 1 pint spirits of wine.

Mix ½ ounce each of the attars of lavender and bergamot, and 1 drachm attar of cloves, with 1 pint spirit of wine.

Mix ¼ ounce attar of lemon grass, and ½ ounce essence of lemons, with 1 pint spirit of wine.

Mix ¼ ounce attar of petit-grain, and ¼ ounce attar of orange peel, with 1 pint spirits of wine.

These mixtures are filtered through blotting paper with the addition of a little magnesia to make them bright. It would be well if all the cheap perfumes put up in attractive bottles were as good as these mixtures. A large proportion of them are far inferior, and frequently little more than weak perfumed waters.

1027. To Make Imitation Bay Rum. The genuine bay rum is made by digesting the leaves of the Bay plant (an aromatic plant which grows in the West Indies), in rum, and subsequent distillation. The imitation is prepared from the essential oil obtained from the Bay plant. Mix 1 ounce of oil of Bay (or ¾ ounce oil of Bay, and ¼ ounce of either oil of pimento, allspice, or cloves), with 4 gallons 95 per cent. alcohol; then add gradually 4 gallons of water, shaking the mixture constantly. If the mixture should become milky, the addition of a little alcohol will make it clear. Probably the best imitation is as follows: 10 fluid drachms oil of Bay, 1 fluid drachm oil of pimento, 2 fluid ounces acetic ether, 3 gallons alcohol, and 2½ gallons water. Mix, and after 2 weeks' repose, filter.

1028. West India Bay Rum. Take 2 pounds of leaves of the myrtus acris, ½ pound cardamoms, 2 ounces cassia, 1½ ounces cloves, and 9 quarts rum. Distill 1½ gallons. Bay rum may be colored with tincture of saffron, or with a mixture of equal parts caramel (*see No.* 694) and tincture of turmeric.

1029. Cheap Bay Rum. Saturate a ¼ pound block of carbonate of magnesia with oil of Bay; pulverize the magnesia, place it in a filter, and pour water through it until the desired quantity is obtained, then add alcohol. The quantity of water and of alcohol employed depends on the desired strength and quality of the Bay rum.

To Prepare Flavoring Extracts.

The following excellent receipts, taken from the "American Journal of Pharmacy," are by Prof. W. Procter, Jr.

1031. Lemon Extract. Expose 4 ounces of the exterior rind of lemons in the air until partially dry; then bruise in a wedgewood mortar; add to it 2 quarts deodorized alcohol of 95°, and agitate until the color is extracted; then add 6 ounces recent oil of lemon. If it does not become clear immediately, let it stand for a day or two, agitating occasionally. Then filter.

1032. Orange Extract. Follow the same method as for *lemon extract,* using 4 ounces exterior rind of oranges, 1 quart of deodorized alcohol of 95°, and 2 ounces recent oil of orange.

1033. Extract of Bitter Almonds. Mix together 4 ounces oil of bitter almonds, 1 ounce tincture of turmeric, and 1 quart 95° alcohol.

1034. To Neutralize the Poison in Extract of Bitter Almonds. As this extract is poisonous in a quantity, it is better to deprive it of its hydrocyanic acid as follows:—Dissolve 2 ounces sulphate of iron in a pint of water; in another pint of water slake 1 ounce lime recently burned; mix them together, and shake the mixture with 4 ounces oil of bitter almonds. Distill in a glass retort until the whole of the oil has passed over; and after allowing the oil time to separate from the water, remove it for use.

1035. Extract of Rose. Bruise 2 ounces of hundred-leaved rose-leaves; make an extract from them by macerating in 1 quart deodorized alcohol; press the quart of alcohol out, and add to it 1 drachm oil of rose, and filter through paper. If there are no red rose leaves, a little tincture of cochineal will give a pale rose tint.

1036. Extract of Cinnamon. Dissolve 2 drachms oil of cinnamon in 1 pint deodorized alcohol; add gradually 1 pint of water, and then stir in by degrees 4 ounces powdered Ceylon cinnamon; agitate several hours, and filter through paper.

1037. Extract of Nutmegs. Mix 2 drachms oil of nutmegs with 1 ounce powdered mace; macerate for 12 hours in 1 quart deodorized alcohol, and filter.

1038. Extract of Ginger. Pack 4 ounces powdered ginger in a percolator, moisten it with a little alcohol, then pour on alcohol until 1½ pints of tincture have passed through. Mix this with 8 ounces syrup.

1039. Extract of Black Pepper. This is prepared from powdered pepper in the same manner as the extract of ginger, pouring on alcohol until a quart has passed through, and omitting the syrup.

1040. Extract of Capsicum. Prepared from powdered capsicum, in the same manner as black pepper.

1041. Extract of Coriander. Mix 4 ounces powdered coriander with 1 drachm oil of coriander; add the mixture to 1½ pints alcohol of 95°, and ½ pint water; macerate for 24 hours, decant the liquid; put the matter that has settled into a percolator, and pour on it the decanted liquid, adding alcohol until a quart has run through.

1042. Extract of Vanilla. Cut 1 ounce vanilla into small pieces, and triturate with 2 ounces sugar to a coarse powder; put it into a percolator, pour on it diluted alcohol until 1 pint has run through—then mix with 1 pint syrup.

1043. Extract of Celery. Bruise 2 ounces celery seeds, and put into a percolator; pour on 1 pint deodorized alcohol, then pour on water till a pint of extract has passed through; triturate with 1 drachm carbonate of magnesia, and filter.

1044. Extract of Soup-herbs. Put into a percolator 1 ounce each of thyme, sweet marjoram, sweet basil, and summer savory, and 1 drachm celery seeds. Pour on them sufficient diluted alcohol to make 1 pint of extract.

Artificial Fruit Essences.

These are composed chiefly of compound ethers, which possess the odor and flavor of certain fruits. In some of the following receipts, where tartaric, oxalic, succinic or benzoic acid enters into the composition of an essence, it must be understood that these acids are not to be used in their pure state, but in the form of saturated solutions (*see No.* 27) *in cold* alcohol. Glycerine will be found as an ingredient in nearly all these artificial essences; it seems to blend and harmonize the different odors.

1046. Peach Essence. This is a mixture of 5 parts glycerine, 2 parts aldehyde, 5 parts acetate of ethyl, 5 parts formiate of ethyl, 5 parts butyrate of ethyl, 5 parts valerianate of ethyl, 5 parts œnanthylate of ethyl, 1 part sebacic ether, and 2 parts salicylate of methyl.

1047. Apricot Essence. To 4 parts glycerine add 1 part chloroform, 10 parts butyrate of ethyl, 5 parts valerianate of ethyl, 1 part œnanthylate of ethyl, 2 parts salicylate of methyl, 1 part butyrate of amyl, and 1 part saturated solution of oxalic acid in alcohol. (*See No.* 1045.)

1048. Plum Essence. To 8 parts glycerine, add 5 parts of aldehyde, 5 parts acetate of ethyl, 1 part formiate of ethyl, 2 parts butyrate of ethyl, and 4 parts œnanthylate of ethyl.

1049. Cherry Essence. Take 3 parts glycerine, 5 parts acetate of ethyl, 5 parts benzoate of ethyl, 1 part œnanthylate of ethyl, and 1 part saturated solution (*see No.* 1045) of benzoic acid in alcohol.

1050. Black Cherry Essence. Mix 10 parts acetate of ethyl with 5 parts benzoate of ethyl, 2 parts œnanthylate of ethyl, 1 part saturated solution of oxalic acid, and 2 parts solution of benzoic acid. (*See No.* 1045.)

1051. Lemon Essence. To 5 parts glycerine, 1 part chloroform and 1 part nitric ether, add 2 parts aldehyde, 10 parts acetate of ethyl, 10 parts valerianate of amyl, 10 parts solution of tartaric acid, and 1 part saturated solution of succinic acid. (*See No.* 1045)

1052. Pear Essence. To 10 parts glycerine add 5 parts acetate of ethyl and 10 parts acetate of amyl.

1053. Orange Essence. With 10 parts glycerine, mix 2 parts chloroform, 2 parts aldehyde, 5 parts acetate of ethyl, 1 part each of formiate, butyrate and benzoate of ethyl, 1 part salicylate of methyl, 10 parts acetate of amyl, 10 parts essence of orange, and 1 part saturated solution of tartaric acid. (*See No.* 1045.)

1054. Apple Essence. To 4 parts glycerine, 1 part chloroform, and 1 part of nitric ether, add 2 parts aldehyde, 1 part acetate of ethyl, 10 parts valerianate of amyl, and 1 part saturated solution of oxalic acid. (*See No.* 1045.)

1055. Grape Essence. To 10 parts glycerine and 2 parts chloroform, add 2 parts aldehyde, 2 parts formiate and 10 parts œnanthylate of ethyl, 1 part salicylate of methyl, and 5 parts tartaric and 3 parts succinic acids in saturated solution. (*See No.* 1045.)

1056. Gooseberry Essence. To 1 part aldehyde add 5 parts acetate, 1 part benzoate and 1 part œnanthylate of ethyl, and 5 parts saturated solution of tartaric, and 1 part each of the same of succinic and benzoic acids. (*See No.* 1045.)

1057. Raspberry Essence. To 4 parts glycerine and 1 part nitric ether, add 1 part aldehyde, 5 parts acetate of ethyl, and 1 part each of formiate, butyrate, benzoate and œnanthylate of ethyl, 1 part sebacic ether, 1 part salicylate of methyl, 1 part each acetate and butyrate of amyl, 5 parts tartaric and 1 part succinic acid in saturated solution. (*See No.* 1045.)

1058. Strawberry Essence. To 2 parts glycerine and 1 part nitric ether add 5 parts acetate, 1 part formiate and 5 parts butyrate of ethyl, 1 part salicylate of methyl, and 3 parts acetate and 2 parts butyrate of amyl.

1059. Melon Essence. Take 3 parts glycerine, 2 parts aldehyde, 1 part formiate, 4 parts butyrate and 5 parts valerianate of ethyl, and 10 parts sebacic ether.

1060. Pineapple Essence. To 3 parts glycerine and 1 part chloroform add 1 part aldehyde, 5 parts butyrate of ethyl and 10 parts butyrate of amyl.

Extraits; Extracts.

In French perfumery these are, appropriately, strong spirituous solutions, either simple or compound, of the essential oils and odorous principles of plants and other substances, obtained by infusion or digestion, as distinguished from those that are obtained by distillation and direct solution. Under the term, however, are often classed many perfumes prepared with rectified spirit by the latter methods, and which are highly charged with the fragrant matter, or matters, which they represent. The preparation of most of the extraits is simple enough, the chief care necessary being that the spirit be absolutely scentless and of sufficient strength, and that the oils and other materials be recent and perfectly pure.

1062. Extrait de Rondeletia. Take 12 drachms avoirdupois oil of lavender (Mitcham); oil of cloves, 5 drachms; oil of bergamot, 4 drachms; oil of verbena (or neroli), 1 drachm; essence of ambergris and essence of musk, of each ½ Imperial fluid drachm; rectified spirit (90 per cent.), 1 pint; mix. A rich and highly esteemed perfume.

1063. Extrait de Millefleurs. Take 4 grains finest grain musk; finest ambergris, 6 grains; oil of lemon, 6 drachms; oil of lavender (English), and oil of cloves, each 4 drachms; liquid storax (genuine), 1 drachm; oil of verbena, oil of pimento and neroli, of each 12 drops (minims); rectified spirit, 1 Imperial pint; macerate in a warm room, with frequent agitation, for 2 or 3 weeks. Very fine. The omission of the storax renders it paler, and thus preferable to some persons.

1064. Jockey Club Bouquet. Mix 1 pint extract of rose, 1 pint extract of tuberose, ½ pint extract of cassia, 4 ounces extract of jasmin, and 3 ounces tincture of civet. Filter the mixture.

1065. Bouquet de Millefleurs. Mix 1 pint extract of rose; ½ pint each of the extracts of tuberose, jasmin, orange-flower, cassia, and violet; 4 ounces essence of cedar, 2 ounces each of the tinctures of vanilla, ambergris, and musk; ½ pint essence of rose, 1 ounce attar of bergamot, and 10 drops each of the attars of almonds, neroli, and cloves. Let the mixture stand for a week, and then filter.

1066. Bouquet de Rondeletia. Mix 2 ounces attar of lavender, 1 ounce attar of cloves, 1 ounce attar of bergamot, 3 drachms attar of roses, 4 ounces each of the tinctures of musk, vanilla, and ambergris, with 1 gallon deodorized alcohol. After a month's repose, filter.

1067. Imitation Lily of the Valley. This much admired perfume is made by mixing together ½ pint extract of tuberose, 1 ounce extract of jasmin, 2 ounces extract of orange-flower, 3 ounces extract of vanilla, ¼ pint extract of cassia, ¼ pint extract of rose, and 3 drops attar of almonds. Keep this mixture for a month and then use.

1068. Imitation Essence of Myrtle. Mix together and allow to stand for 2 weeks, ½ pint extract of vanilla, 1 pint extract of roses, ½ pint extract of orange-flower, ½ pint extract of tuberose, and 2 ounces extract of jasmin.

1069. Extract of Patchouli. Mix 1¼ ounces attar of patchouli, and ¼ ounce attar of rose, with 1 gallon rectified spirits.

Aromatic, Odoriferous, or Perfumed Waters, &c.

These are strictly pure water charged by distillation with the volatile, aromatic, and odorous principles of plants; or they are solutions of these principles, chiefly the essential oils, in distilled water. The simple fragrant waters of the perfumers are of the former kind; those of the wholesale druggists and of pharmacy belong to either class, according to the mode of their preparation.

1071. Proportions of Aromatics Submitted to Distillation for Making Perfumed Waters. The vegetable matter (bruised, if necessary), in the quantity ordered, is to be put into the still along with 2 gallons of pure water, but only 1 gallon drawn over. In this way the finest fragrant distilled waters may be produced from all flowers, and other aromatic vegetable substances. The points requisite to be attended to are, that the flowers be fresh, gathered after the sun has risen and the dew exhaled, and that sufficient water be used to prevent the flowers being burned, but not much more than is sufficient for this purpose. The quantities usually directed are: Roses, 8 pounds (avoirdupois); water, 2 gallons (Imperial); distill 1 gallon for *single*, and the same water with 8 pounds of fresh roses for *double* rose water. The usual quantities of aromatic material required in proportion to the amount of distilled water to be obtained, are given in classified form in the Journal de Pharmacie as follows: Fresh aromatic plants, such as wormwood, black-cherry, scurvy-grass, hyssop, cherry-laurel, lavender, balm, mint, peach-leaves, roses, and sage, require 1 part of the plant for each part distilled product desired. Fresh and dry aromatics, as bitter almonds, orange-flowers, melilot, horse-radish, elder, and tansy, require 1 part of the plant to 2 parts of distilled product. Dry and very aromatic plants, as angelica, green anise, juniper berries, camomile, canella, cascarilla, fennel, sassafras, linden-flowers, and valerian, require 1 part of the plant to each 4 parts of distillate. These proportions will be some guide both in respect of the distilled waters referred to, and others not included in the list. In general, druggists draw over 2 gallons of water from the respective quantities of flowers, herbs, bark, or seeds, ordered in the pharmacopœias, quantity rather than quality being their object. Manufacturing perfumers, on the contrary, either use an excess of flowers for their finer odoriferous waters, or they preserve only the first and stronger portion of the water that distills over; the remainder being separately collected and used for a second distillation with fresh flowers. In some cases, where a very superior quality is desired, they re-distill the water of the first distillation and preserve only the first ⅔, or even only the first half, that passes over.

1072. Elder-flower Water, Acacia-flower Water, and Bean-flower Water, are prepared in the same manner as rose water. (*See Nos.* 1071 *and* 1079.)

1073. Directions for Distilling Perfumed Waters. The following directions are, in the main, those given by the thoroughly practical chemist, Mr. Arnold J. Cooley. In the distillation of odoriferous waters, manufacturing perfumers employ their utmost care, in order to produce a highly fragrant article, free from any contamination that can vitiate the purity of their odor, or lessen their keeping qualities. The still may be of copper, but the head and worm should be formed of solid tin. It should be furnished with a high and narrow neck to prevent the liquor in it spirting over into the neck and condensing-worm. A still furnished with a steam-jacket is the most convenient for the purpose, as the heat of steam, or of a salt-water bath, can alone be safely employed. The common plan is to reject the first 2 or 3 fluid ounces that pass over, and to collect the remainder of the runnings until the proper quantity be obtained. The whole product is then agitated together, and stored, loosely covered, in a cool cellar for some weeks, or even months, in order that it may lose its herbaceous odor and the rawness from recent stillage. It is a common practice to separate any volatile oil floating on waters after distillation, but Mr. Haselden, of England, recommends the excess of oil to be well shaken with the water and the whole transferred to the stock vessel, where the oil will separate; it keeps better thus treated, and full strength is ensured. He prefers the stock vessel to be of stoneware, furnished with a tap about 2 inches from the bottom, whereby the water can be drawn out clear, the oil either rising to the top or sinking to the bottom, according to its specific gravity. As soon as it has acquired its full odor, or reached maturity, it is carefully decanted into bottles, which are then well corked or stopped, and stored in a moderately cool place. Some of the leading manufacturing perfumers keep a separate still for each of their more delicate distilled waters, and thoroughly clean them out and dry them after each distillation, as it is extremely difficult to remove any odor or taint that adheres to the still, still-head, and worm. Even blowing steam through them for some hours will not always sufficiently purify them for this species of distillation. In the preparation of distilled waters for medicinal purposes, a clean, sweet still, still-head, and worm, must also be employed. The two last should be of tin or glazed stoneware; and the receivers should be of glass or stoneware. The utmost care should be taken to prevent contamination of distilled waters by contact with copper, lead or zinc, since they slowly oxidize and dissolve these metals. In almost all cases, salted or pickled flowers, herbs, &c., are greatly superior to the fresh vegetables for the preparation of fragrant distilled waters. When the former are employed the product has little or none of the herbaceous and raw odor which is always present when the latter are used, besides which they keep better, and reach maturity, or the full development of their odor, in a much shorter time. (*See No.* 1349.) Carefully prepared distilled waters keep well, and are not liable to any change, but when the reverse is the case, particularly when the liquor in the still has spirted over the neck of the still-head into the condensing worm, they are apt to acetify, and even to become ropy and viscid. A common, but very objectionable plan, in such cases, is to agitate them with a little carbonate of magnesia, and to filter them through paper. The only safe remedy is to re-distill them on the first indication of such change, for magnesia weakens them. Indeed, all their essential oil and fragrance may be removed by increasing the quantity of it. If magnesia, in any form, be used for filtering distilled waters, it should be the carbonate; but a little of even that will be dissolved if the water be ever so slightly acidulous.

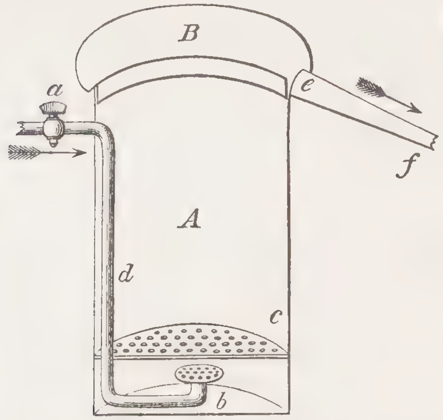
1074. To Remove the Burnt Smell of Freshly Distilled Waters. The burnt smell of waters, frequently arising from careless stilling, is usually lost, or greatly lessened, by freezing, or by exposure to a temperature approaching the freezing point; but if the water be highly charged with essential oil, part of the latter will separate, and thus the water will lose some of its fragrance. (*See No.* 1076.)

1075. To Prevent Distilled Waters from Souring. To prevent carelessly prepared distilled waters acetifying or turning sour, and to recover those which have begun to spoil, a common plan is to shake them up with a little calcined magnesia, or to dissolve in each pint of them 1 grain each of powdered borax and alum. This, however, is not to be recommended, as it unfits the waters for use as vehicles. Whenever it is unavoidably had recourse to, the best plan is to re-distill the water a few days afterwards.

1076. Practical Suggestions for Making Distilled Waters. There are certain general rules or points to be adhered to in distilling perfumed waters: Dry, hard, or fibrous substances should be mechanically divided, and macerated in water before undergoing distillation. Too great a quantity of materials should not be introduced at one time into the body of the still; if this precaution be neglected, there is a risk of the liquid boiling over or spirting into the receiver. Ebullition should be attained as quickly as possible, and be continuous. Sufficient water should be left undistilled to cover the matter in the still, to guard against its coming in contact with the sides of the vessel. In this case the matter would be decomposed by the heat, and yield empyreumatic products; besides, if the distillation is carried too far, a slimy formation is apt to adhere to the sides of the still, which would also be decomposed by the heat, and have a similar effect on the product. These risks may be greatly lessened, if not entirely avoided, by applying heat by means of an oil-bath, regulated by a thermometer; and still better by a bath containing a solution of chloride of calcium (muriate of lime). Any degree of heat between 212° and 285° Fahr. may be obtained and sustained by regulating the strength of the solution. (*See No.* 7.) Another convenient method is by steam. (*See No.* 1077.) Waters distilled from plants are apt to have a smoky odor at first, even when the greatest care and precaution have been observed in their distillation; exposure for a short time to the air will remove this, after which they should be kept in closely-stoppered bottles, and preferably in bottles containing only sufficient for probable use at one time; they should be entirely filled and closed air-tight.

1077. Soubeiran's Steam Apparatus for Distilled Waters. The illustration given is a vertical section of Soubeiran's apparatus used in France for obtaining distilled waters. A cylindrical tinned-copper or iron boiler, *A*, of convenient size, say 3½ feet high and 2 feet in diameter, is surmounted by an expanded head or capital, *B*, which is furnished with an inner ledge, forming a kind of gutter, to receive the liquid condensed on the inner surface of the capital, and opening into the exit tube, *e*. About 6 inches from the bottom of the cylinder is placed a false bottom or diaphragm, *c*, pierced with small holes. A steam pipe, *d*, having a stop-cock, *a*, is introduced in the cylinder in the manner shown, terminating in an expansion, *b*, perforated like the rose of a watering-pot, and located a little below the diaphragm.

The material to be distilled, after proper preparation, is placed upon the diaphragm, the capital, *B*, is applied and luted with dextrine paste; steam is passed through the tube, and issuing from *b*, passes through the material, becomes loaded with the volatile matter, rises into the capital, condenses, and passes through *f*, into a worm or other suitable condenser.



1078. Vanilla Water. Macerate 1 pound vanilla in coarse powder, and 5 pounds salt in 2½ gallons water for 24 hours. Then distill over rapidly 1 gallon.

1079. Rose Water. Take 48 Troy ounces pale rose, and 16 pints water. Mix them and distill 8 pints. When it is desirable to keep the rose for some time before distilling, it may be preserved by being well mixed with ½ its weight of chloride of sodium (table salt). U. S. Ph. (*See No.* 1008.)

1080. To Prepare Aromatic Waters from Essential Oils. The United States Pharmacopœia, although not discarding altogether the process of distillation in the preparation of aromatic water, directs, in preference, that water should be impregnated with the volatile oil by trituration with carbonate of magnesia, and subsequently filtered. This is the most simple and easy process. The water is obtained pure and transparent, the magnesia being separated by the filtration. The object of the magnesia is simply to enable the oil to be brought to a minute state of subdivision, and thus present the largest possible surface to the water; but its use is open to the objection that it is slightly soluble in water, and is apt to produce, under certain circumstances, a slightly flocculent precipitate. It has been recommended to use porcelain clay, finely powdered glass, or pumice stone, instead of magnesia, as these substances are wholly insoluble. (*See No.* 1073 *and* 1081.)

1081. Aromatic or Perfumed Waters. Take 2 fluid drachms of the essential oil of the plant, triturate with 2 drachms levigated powdered silex; then add very gradually, with constant trituration, 8 pints distilled water. After brisk agitation for some time, filter the solution through filtering paper wetted with pure water. This is a convenient method for the extemporaneous preparation of perfumed waters, but, without great care in manipulating, the products are inferior in strength to those obtained by distillation. Finely powdered or levigated glass may be used when silex (quartz) is unobtainable. Magnesia and sugar were each formerly used for the purpose, but are objectionable. (*See No.* 1080.

1082. Aromatic or Perfumed Waters. Instead of preparing the waters directly from the essential oils, an essence may be made by dissolving 1 Imperial fluid ounce of the essential oil in 9 fluid ounces rectified spirit; 2 Imperial fluid drachms of the essence agitated briskly for some time with 1 Imperial pint distilled water, and filtered through wet filtering paper, will make a good perfumed water. Cooley says this is an excellent formula for extemporaneous waters; but the U. S. Dis. pronounces them feeble for medicated purposes, in the properties of their respective essential oils. (*See No.* 1008.)

Aromatic Vinegar—Vinaigre Aromatique.

This is a compound of strong acetic acid with certain powerful essential oils. To produce the finer qualities of aromatic vinegar, glacial acetic acid must alone be employed. Aromatic vinegar is used as a pungent and refreshing nasal stimulant in languor, faintness, nervous headaches, dimness of sight, &c. For this purpose it is generally dropped on a small piece of sponge placed in a stoppered bottle, or a vinaigrette, which is only smelt at. It forms a useful caustic for warts and corns. As it is highly corrosive, it should be kept from contact with the skin and clothes. (*Cooley.*)

1084. Fine Aromatic Vinegar. Take of glacial acetic acid, 1 pound avoirdupois; rectified spirit, 2 Imperial fluid ounces; camphor (pure, crushed small), 2½ ounces; oil of cloves (finest), 1½ drachms; oil of rosemary, 1 drachm; oil of bergamot, oil of cinnamon, oil of lavender, oil of pimento, neroli (or essence de petit-grain), of each, ½ drachm; mix (in a stoppered bottle), and agitate until the whole of the camphor is dissolved. Very fine, and highly esteemed.

1085. Aromatic Vinegar. Take of camphor, 1 ounce avoirdupois; oil of cloves, 1 drachm; oil of cedrat, and lavender (Mitcham), of each 40 grains; oil of bergamot and thyme, of each 20 grains; oil of cinnamon, 10 grains; glacial acetic acid, ½ pound; mix as before. Very fine.

1086. Henry's Aromatic Vinegar. This resembles the preceding, except in being strongly scented with the oils of cloves, lavender, rosemary, and calamus aromaticus only.

1087. Vinaigre Aromatique. Take of camphor, 1 ounce avoirdupois; oil of cloves, 15 grains; oil of cinnamon, 10 grains; oil of lavender (English), 5 or 6 grains; glacial acetic acid, ½ pint. As the last. It is improved by doubling the quantities of the essential oils.

1088. Acetic Perfumes. The stronger aromatic or perfumed vinegars fall under this class of preparations; as do also various esprits and eaux (alcoöliques) to which a marked acetic odor has been given by the addition of concentrated acetic acid. The latter may be conveniently prepared by simply adding 1 to 1½ fluid ounces of glacial acetic acid to each ½ pint of scented spirit. For acetic eau de Cologne and other like perfumes, 1¼ to 2 ounces of acid, per pint, is generally sufficient.

Smelling Salts.

Sesquicarbonate of ammonia commonly passes under this name, and, with the addition of a few drops of essential oil, is frequently employed to fill smelling bottles. Its pungency, however, is neither so great nor so durable as that of the true or neutral carbonate of ammonia. The latter salt continues unchanged in composition, and preserves its pungency as long as a particle of it remains unvolatilized. The portion only which flies off suffers decomposition as it volatilizes, separating into gaseous ammonia and carbonic acid. The pungency of the sesquicarbonate, on the other hand, depends solely on its gradual decomposition, in the solid state, into carbonate of ammonia, which flies off under exposure to the air; and into bicarbonate of ammonia, which is much less volatile and only slightly pungent, and which remains behind; the weight of the latter being far greater than one-half the weight of the original salt. Carbonate of ammonia, and not the sesquicarbonate, should, therefore, be alone used in filling smelling bottles, if a strong, agreeable, and durable pungency be desired. It is employed, either directly or indirectly, by the makers of all the more esteemed smelling salts of the day; and their predecessors did the same, even long before the chemistry of the two salts, and the rationale of the properties which cause a preference for the one, were known. (*Cooley.*)

1090. Fine Smelling Salts. Take of carbonate of ammonia (crushed small), 1 pound avoirdupois; oil of lavender (Mitcham), oil of bergamot, of each 1 Imperial fluid ounce; oil of cloves, 2 fluid drachms; oil of cassia, 1 fluid drachm. Rub them thoroughly together, sublime at a very gentle heat into a well-cooled receiver, and at once put the product into a well-stoppered bottle, or bottles. The sublimation may be omitted, but the quality of the product suffers. This is varied in some samples, by substituting 1 ounce of oil of lemon, or a little of the oils of rosemary and sweet flag (calamus aromaticus), for the oils of cloves and cassia; or by adding (after sublimation) a dash (2 or 3 drops per bottle) of essence of musk or essence royale.

1091. Smelling Salts. As before, but taking as perfume, oil of bergamot, 2 fluid ounces; oil of verbena, ½ fluid ounce; attar of roses, 1 to 2 drachms. It is varied as in the last.

1092. Smelling Salts. Same as No. 1090, but using oil of bergamot and lemon, of each, ¾ fluid ounce; essence de petit-grain, 3 fluid drachms; oil of cloves and cassia, of each, 1 fluid drachm; varied, as before, at will.

1093. Inexhaustible Smelling Salts. Take 1 pint liquid ammonia, 1 drachm attar of rosemary, 1 drachm attar of lavender, ½ drachm attar of bergamot, and ½ drachm attar of cloves. Mix together by agitation in a very strong, well-stoppered bottle. To prepare a smelling-bottle of this mixture, fill a stopper-bottle with pieces of sponge, previously well beaten, washed and dried; pour into the bottle as much of the mixture as the sponge will absorb, but not sufficient for a drop to escape if the bottle be inverted.

1094. Aromatic Spirit of Ammonia. Take of carbonate of ammonia, 8 ounces avoirdupois; strong liquor of ammonia (.882) 4 Imperial fluid ounces; volatile oil of nutmeg, 4 fluid drachms; oil of lemon, 6 fluid drachms; rectified spirit, 6 pints; water, 3 pints; mix, and distill 7 pints. Specific gravity .870. This is now the only authorized formula. The product is excellent, and very agreeable in use. (*Br. Ph.*)

1095. Ammoniated Perfumes. These are prepared by either adding strong liquor of ammonia to the liquid perfumes (eaux, esprits, &c.,) in sufficient quantity to impart to them a pungent ammoniacal odor, or by adding to the articles, before distillation, the ingredients that, by their mutual reaction, produce ammonia. In the former case, ½ to 1½ fluid ounces of liquor of ammonia (.880-.882), per pint, will be required, according to the nature of the preparation and the degree of pungency desired; and in general, when much essential oil is present, a spirit of higher strength than usual should be employed for the esprit, to compensate for its subsequent dilution by the ammonia. In the other case, 4 to 5 drachms of sal ammoniac, and 7 to 8 drachms of carbonate of potash for each pint of the product intended to be drawn over, are mixed with the cold ingredients just before distillation. For this use the liquor of ammonia must be perfectly free from tarry or empyreumatic matter, and have a purely ammoniacal odor.

1096. Ammoniated Eau de Cologne; Ammoniacal Cologne Water. As a perfume, this is best prepared by either of the methods noticed under ammoniated perfumes. It is now very extensively employed as a substitute for spirit of sal volatile. When intended for use in this way, a more agreeable and effective article may be produced by adding 1 ounce of carbonate (sesquicarbonate) of ammonia, and ½ fluid ounce of the strong liquor of ammonia to each pint of the product, or intended product, which will then have about the strength of the officinal spirit of sal volatile (spiritus ammoniæ aromaticus) of the British Ph. That of the stores has usually only little more than half this strength.

1097. Eau de Lavande Ammoniacale. To each Imperial pint of eau de lavande (*see No.* 989), add of liquor of ammonia (.880-.882), ½ to 1 fluid ounce.

1098. Ammoniacal Lavender Water. Take of oil of lavender (English) 1 fluid ounce; spirit of ammonia (caustic) 1½ pints; mix. The product is the officinal preparation of the French. Used as a stimulating pungent scent, in fainting, headaches, &c.

Perfumed Powders and Rouges.

Powders for the hair and skin have almost gone out of use. The basis of perfumed powders is either orris, or fine pearl starch. The perfume of the finest kinds is imparted by alternating layers of starch and fresh flowers, the latter being afterwards separated by sifting. The simple perfumed powders thus obtained, by judicious admixture, form compound or bouquet powders. The tediousness and expense of this process prevent its general employment. The common mode is to scent by the direct addition of extracts or essential oils, or else to mix in powdered fragrant material with the orris or starch.

1100. Violet Powder. Wheat starch, 12 pounds; powdered orris, 2 pounds. Mix together, and add attar of lemon, ½ ounce; attars of bergamot and cloves, each 2 drachms.

1101. Poudre d'Iris. Powdered orris root, 12 pounds; powdered bergamot peel, and acacia flowers, each 8 ounces; powdered cloves, ½ ounce. Mix and sift.

1102. Prepared Bran for the Hair. Powdered wheat bran, 1 pound; powdered orris, 2 ounces. Mix and sift.

1103. Poudre Noir for the Hair. Starch and orris in fine powder, each 8 ounces; charcoal and ivory black, in fine powder, each 1 ounce. Mix and sift.

1104. Poudre Blonde for the Hair. Finely powdered starch and orris, 8 ounces each; as in the preceding, but with yellow ochre for the coloring matter.

1105. Poudre à la Vanille Brune for the Skin or for Sachets. Powdered vanilla, rose-leaves, lump storax, benzoin, rhodium, pallisandre and ebony woods, each 1 pound; powdered cloves, 2 ounces; powdered musk, 2 drachms. Mix together with 3 pounds of starch; sift, and add a few drops of extracts of tuberose and jasmin.

1106. Poudre à l'Œillet Composée—for the Skin or Sachets. Powdered rose leaves and orris root, each 3 pounds; powdered bergamot peel, 1 pound; powdered cloves and cinnamon, each 6 ounces; powdered acacia and orange flowers, each 8 ounces; starch, 3 pounds.

1107. Paints or Rouges for the Skin. Paints or rouges are the means by which the natural color of the skin may be heightened or changed. They are, however, objectionable preparations, and the use of them extends very little beyond the theatres, where they are employed to produce stage effect.

1108. French White. This is the mineral talc, or French chalk, finely powdered and bolted. It forms the basis of the most harmless rouges. Perfume is added as may be desired.

1109. Pearl White. Pure oxide or subnitrate of bismuth in powder. This pigment darkens in atmospheres containing sulphide of hydrogen. 1 ounce triturated with 4 ounces of orange-flower water makes liquid white for theatrical use.

1110. Pearl Powder. Precipitated chalk finely bolted and perfumed. The French add oxides of zinc and bismuth, each 1 ounce to the pound of chalk.

1111. Caution against Bismuth as a Cosmetic. The continued use of bismuth-white injures the skin, and ultimately produces paralysis of its minute vessels, rendering it yellow and leather-like—an effect which, unfortunately, those who employ it generally attempt to conceal by its freer and more frequent application.

1112. Carmine Rouge. Finely bolted talc, 4 ounces; carmine, 2 drachms. Mix together with a little warm and dilute solution of gum tragacanth. For lighter shades, the proportion of carmine must be diminished. For commoner pastes, rose-pink replaces the carmine as coloring matter. It may be made into a pomade.

1113. Bloom of Roses. Powdered carmine of the best quality, 2 drachms, digested with strong ammonia, 4 ounces, in a tightly stoppered bottle for 2 days, at the ordinary temperature of the atmosphere. Then add rose water, 1 pint; and essence of rose, 4 ounces. After standing for a week to settle, the clear liquid may be poured off from the sediment, and bottled.

1114. Azure Paste. Talc and ultramarine, finely bolted, equal parts, triturated with a solution of gum tragacanth into a stiff paste.

1115. Enamel Powder. Take equal parts finely scraped talc or French chalk, and pearl-white; sufficient rouge or carmine to slightly tinge it; mix. Used to conceal discolorations; and, without the coloring, to whiten the skin.

Cosmetics for the Skin and Complexion.

The preparations under this head are designed to soften the skin and beautify the complexion. We annex receipts for the more important. The heating medium in the manufacture of them must be either a water or steam bath.

1117. To Make Amandine. Put into a large marble mortar 2 ounces gum arabic, and 6 ounces white honey; triturate, and when the mixture has been rubbed into a thick paste, add 3 ounces perfectly neutral almond shaving cream. (*See No.* 602.) Then continue the trituration until the mixture has become homogeneous. 2 pounds of fresh cold-pressed sweet almond oil are next allowed to flow from a can above into the mortar, but only as rapidly as it can be incorporated with the mass; otherwise, if it enters in too large quantities, the blending is imperfect, and the amandine becomes *oily* instead of jelly-like and transparent, as it should be when the manipulation has been skillful. In summer temperatures it will be difficult to effect a combination of all the oil; and, therefore, the flow should be stopped as soon as the mixture becomes bright and assumes a crystalline lustre. The perfume should be mixed with the almond oil, and consists of ½ drachm attar of bitter almonds to every pound of paste. A little attar of rose and bergamot may also be added—about 1 drachm of each. As soon as finished it must be put in close pots.

1118. To Use Amandine. To produce amandine of fine quality is a matter of some difficulty and labor, and requires experience and considerable manipular skill. The details essential to success are noticed under "Emulsions." (*See No.* 43.) A small quantity, say a lump of filbert size, gives with warm water a rich lather, which, when rubbed over the face and hands, imparts softness, and prevents chapping. It should be wiped off while still in lather, with a dry towel.

1119. Glycerine Amandine. As the preceding, but adding, with the shaving cream, ¾ to 1 ounce of Price's glycerine for every pound of oil intended to be subsequently added.

1120. Colored Amandine. Amandine may be colored green with spinach-leaves, and yellow and orange with palm oil or annotto, by digesting or dissolving the substances in the oil before adding the scents. A beautiful scarlet or crimson may be given to it by adding a little liquid rouge or carmine (ammoniacal), just before removing it from the mortar. *Olivine* is a similar preparation to amandine, but made with olive-oil. It is often colored green.

1121. Cosmetic Balsam of Honey. Take finest pale honey, 4 ounces (avoirdupois); glycerine (Price's), 1 ounce; unite by a gentle heat; when cold, add rectified spirit, 1 fluid ounce (Imperial); essence of ambergris, 6 drops; and at once bottle it. Used to soften and whiten the skin, prevent chaps, &c.

1122. Freckle Balsam. To the balsam of honey prepared as directed in the last receipt, add pure citric acid, 3 drachms. Used to prevent and remove freckles and discolorations.

1123. Almond Paste. Reduce blanched almonds to a very smooth paste by patiently pounding them in a marble mortar, adding gradually, toward the end, a little rose-water, or orange-flower water, with a few drops of attar of roses or neroli, or a little eau de Cologne, or other perfume, at will. Lastly, put the paste into covered porcelain pots or jars.

1124. Bitter Almond Paste. Take equal parts bitter almonds and sweet almonds; and rose-water, a sufficient quantity; and proceed as before. No scent need be added. Both the preceding are occasionally diversified by the addition of either powdered spermaceti in weight equal to about ⅛ part of that of the almonds, or of ½ this weight of white soap. Sometimes the white of an egg is added.

1125. Cold Cream. Take 1 ounce avoirdupois each pure white wax and spermaceti, and ¼ Imperial pint oil of almonds; melt, pour the mixture into a marble or wedgwood-ware mortar (or a porcelain basin), which has been heated by being immersed for some time in boiling water; add, very gradually, of rose-water, 4 fluid ounces; and assiduously stir the mixture until an emulsion is formed, and afterwards until the whole is very nearly cold, Lastly, put it into porcelain or earthenware pots for use or sale.

1126. Hudson's Cold Cream. This is prepared in the same way as the above, with the addition of 1 fluid ounce orange-flower water.

1127. Sultana Cold Cream. Take ½ ounce avoirdupois each, pure spermaceti and white wax; almond-oil, and butter of cacao, each ¼ pound; melt, and stir in of balsam of Peru, 2 drachms. After repose, pour off the clear portion, add orange-flower water, 2 Imperial fluid drachms, and stir it briskly until it concretes. Used like cold cream, lip-salve, &c.

1128. Crême de Cathay. Melt together over a water bath, white wax and spermaceti, each 2 drachms; then add oil of sweet almonds, 4 ounces, and Mecca balsam, 3 drachms; next perfume with rose-water, 6 drachms; stir until cold.

1129. Glycerine Cream. This superior cosmetic is the well-known *cold-cream*, (*see No.* 1125), with glycerine substituted for rose-water. Melt together spermaceti, 6 ounces; and white wax, 1 ounce, in 1 pound of sweet almond oil. Then remove from the fire, and stir in Price's glycerine, 4 ounces; and when congealing, perfume with attar of rose, 20 drops. Other attars may be used as desired, in place of rose.

1130. Rose Glycerine Cream. Spermaceti, ½ ounce; oil of sweet almonds, 2 ounces; white wax, 1 ounce; glycerine, 4 ounces: mix the spermaceti, white wax and oil of almonds together first; then add the glycerine and stir the mixture until cool. Perfume with attar of rose.

1131. Snow Cream. Melt 3 ounces spermaceti, 2 ounces white wax, and 12 ounces fresh oil of almonds, in a water-bath; pour it into a marble mortar, and stir briskly to prevent granulation; when of the consistence of butter, triturate until the mixture has a white, creamy appearance; then, during continued trituration, add by degrees a mixture of 1 ounce double water of roses and 1 ounce odorless glycerine; incorporate for 20 minutes, and add 10 drops essence of roses; beat for about half an hour, put into pots or jars, and close air-tight.

1132. Fine Camphor Ice. Melt together over a water-bath, white wax and spermaceti, each 1 ounce; camphor, 2 ounces; in sweet almond oil, 1 pound. Next, triturate in the manner directed for amandine, and allow 1 pound of rose-water to flow in slowly during the operation. Then perfume with attar of rosemary, 1 drachm. An inferior and cheaper quantity may be made as follows:—

1133. Camphor Ice. Oil of sweet almonds, 2 ounces; spermaceti, 4 ounces; white wax, 2 ounces; camphor, ½ ounce; melt them over a water-bath, run in moulds of proper size and form.

1134. Pate d'Amande au Miel. Rub together 1 pound honey and the yolks of 8 eggs; then gradually add sweet almond oil, 1 pound, during constant trituration, and work in bitter almonds—blanched and ground to meal, 8 ounces; finally perfume with attars of bergamot and cloves, each 2 drachms.

1135. Pomade Rosat. Melt together white wax, 2 ounces; oil of sweet almonds, 4 ounces; alkanet, 3 drachms. Digest for several hours, strain, and add 12 drops attar of rose; used for the lips.

1136. Cacao Pomade. Take of cacao butter, oil of almonds, white wax (pure), equal parts; melt them together, and stir until nearly cold. Used as an emollient skin-cosmetic, particularly for chapped lips, hands, &c. It is sometimes colored with a little palm-oil. Scent may be added at will. It is highly esteemed by some persons as a hair pomade.

1137. Crême de Psyché—for the Lips. White wax and spermaceti, each 1 ounce; oil of sweet almonds, 5 ounces. Melt together, and pour in Mecca balsam, 1 drachm; and stir until the mass congeals, then add 10 grains powdered acetate of lead.

1138. Lait Virginal. Orange-flower water, 8 ounces; and tincture of benzoin, 2 drachms. The former is added very slowly to the latter during constant trituration, so as to produce an opalescent milky fluid.

1139. Crême de Pistache. Pistachio nuts, 3 ounces; green oil, palm soap, wax, and spermaceti, each 1 ounce; orange-flower water, 3¼ pints; essence of neroli, 12 ounces; make as directed for the preceding milks.

1140. Milk of Roses. Place over a water-bath, oil soap, 1 ounce; and melt it in 5 or 6 ounces rose-water; then add white wax and spermaceti, 1 ounce, and continue the heat until they have melted. Next take 1 pound blanched almonds, beat them to a meal in a clean marble mortar, with 3½ pints rose-water, admitted portionwise, during the trituration. (*See No.* 43.) The emulsion of almonds, thus made, is to be strained without pressure through washed white muslin, and run very slowly into the previously formed soap-mixture; the whole being blended at the same time by energetic trituration. Towards the end of this operation, 2 drachms attar of rose, dissolved in 8 ounces inodorous alcohol, are to be let into the mixture very gradually, and in a thin stream, during constant rubbing of the mass. This cautious manipulation is indispensable to the smoothness and perfection of the milk. (*See No.* 43.) The last operation is to strain; and, after the liquid has had a day's repose, to bottle it. This is a highly esteemed cosmetic for the skin and complexion. Milk of cucumbers may be made in the same manner as milk of roses, by substituting juice of cucumbers for rose-water.

1141. Lotion for Freckles. Take bichloride of mercury, 6 grains avoirdupois; pure hydrochloric acid, specific gravity 1.16, 1 Imperial fluid drachm; distilled water, ¼ pint; mix, and add rectified spirit and eau de rose, each 2 fluid ounces; Price's glycerine, 1 ounce.

1142. Lotion to Remove Freckles. Dissolve 3 grains borax in 5 drachms each rose-water, and orange-flower water; a very simple and harmless remedy is equal parts of pure glycerine and rose-water, applied every night, and allowed to dry.

1143. Iodine Lotion for Eruptions of the Skin. Take iodide of potassium, 30 grains avoirdupois; iodine, 15 grains; distilled or soft water, 1 Imperial pint; add only a couple of table-spoonfuls of the water at first, and when by agitation the solids are dissolved, add the remainder. This is the common and best form of ioduretted lotion or wash for ordinary purposes. It is often serviceable in enlarged and indurated glands, itch, &c. Or: take iodide of potassium, 1 to 2 drachms, and distilled water, 1 pint; dissolve.

1144. Glycerinated Lotion of Iodide of Potassium. To the last add 1 ounce Price's glycerine. Both are excellent skin-cosmetics, employed like Gowland's lotion particularly for persons with a scrofulous or scorbutic taint, or who are troubled with eruptions, swellings, or indurations arising from it. It is also excellent as a hair-wash. The product of the last formula may be advantageously used instead of hair-oil.

1145. Lotion of Bichloride of Mercury. Take corrosive sublimate (in coarse powder), 10 grains avoirdupois; distilled water, 1 Imperial pint; agitate them together until solution be complete. The addition of 5 or 6 grains hydrochlorate of ammonia (pure sal-ammoniac) or 5 or 6 drops (not more) hydrochloric acid, increases the solvent action of the water, and renders the preparation less liable to suffer change, but is not otherwise advantageous. When absolutely pure distilled water is not used, this addition of acid should be made to prevent decomposition. Some persons dissolve the sublimate in 2 or 3 fluid drachms rectified spirit before adding the water, to facilitate the process; but this also, though convenient, is unnecessary. Apart from its value as a cosmetic, the above lotion is an excellent application in a variety of obstinate eruptions, and in obstinate sores and glandular swellings and indurations of a minor character; the first of which it seldom fails to relieve, provided the bowels and diet be carefully attended to, and sufficient exercise be taken daily. Ordinary mild cases of itch rapidly disappear under its use. The addition of about 1 ounce pure glycerine converts it into a lotion admirably adapted to allay itching and irritation generally, as well as into one of the best cosmetic washes known. For the latter purpose, a little pure rose water or orange-flower water may be added, at will, to give it fragrance; a like quantity of distilled water, in the case of any of the above additions, being omitted.

1146. Eau de Beauté. Bichloride of mercury (corrosive sublimate), 8 grains; camphor, 10 grains; sulphate of zinc, and solution of lead (liquor of acetate of lead), each 2 scruples; rose water 5¼ ounces; and the yolk of a small egg. This mixture is regularly in use by Creole ladies for beautifying their skin.

1147. Glycerine Lotion. Take Price's glycerine, 1 ounce, and distilled or pure soft water, 19 ounces; mix. A good strength for daily use as a cosmetic wash, or as a vehicle for other ingredients, for which purpose it is greatly preferable to milk of almonds; also as a lotion to allay itching and irritation of the skin, prevent chaps, excoriations, the effects of weather, climate, &c. It is likewise applied to the hair instead of oil.

1148. Glycerine Lotion No. 2. Take of Price's glycerine, 1 ounce, and distilled water, 17 ounces; mix. A proper strength when more marked effects are desired; as in chapped hands, lips, and nipples, obstinate excoriations, abrasions, chafings, sunburns, persistent roughness or hardness of the skin, &c.

1149. Glycerine Lotion No. 3. Take of Price's glycerine, 3 ounces; water, 17 ounces; mix. This is adapted for use in obstinate cases, or when still more rapid effects are desired; also as an application to burns and scalds.

1150. Fragrant Glycerine Lotions. Any of the foregoing glycerine lotions may be rendered fragrant and more agreeable by employing rose water or elder-flower water, instead of water, or by the addition of a little eau de Cologne, lavender water, or other scent, at will. The addition of a few drops of essence of musk or of ambergris, per pint, or of a couple of ounces of eau de rose or eau de fleurs d'oranges, in lieu of an equal bulk of water, imparts a delicate odor which is always highly esteemed. In like manner they may be medicated or increased in efficacy, in various ways, for toilet and personal use.

Thus, the addition of a little borax (2 or 3 drachms per pint), renders them more effective in chaps, excoriations, &c.; a little salt of tartar, or of lemon juice, vinegar, or rectified spirit, increases their power of allaying itching and morbid irritability in skin-diseases, as well as converts No. 1 (more particularly) into an excellent wash for freckles and like discolorations. 8 or 10 grains of bichloride of mercury, per pint, converts it into the admirable lotion of that substance. (*See No.* 1145.) In like manner, by the addition of a drachm or so of iodide of potassium, or of compound tincture of iodine, we have a healthful cosmetic wash particularly serviceable to persons with a scrofulous taint. Strongly scent it with the oils of origanum and rosemary, or impregnate it with a certain proportion of cantharides, or some other appropriate stimulant and rubefacient, and we have respectively the most cleanly, convenient, and useful hair cosmetics. Indeed, merely to enumerate all the uses it may be placed to in the cosmetic and allied treatment of the person, would alone fill many pages.

1151. To Test the Purity of Glycerine. Glycerine weighed at the temperature of 60° Fahrenheit should have no less than 29° B.; if it contains lime or alkalies, one degree should be deducted, as these substances make it heavier.

Rubbed on the hand, it should be perfectly inodorous. Impure glycerine, under this test, has a disagreeable smell. The impurity causing this odor is mostly butyric acid, as by contact with the glycerine it forms a very volatile glycerole. Such an article will always grow worse by age.

The presence of *chlorine*, sometimes used for bleaching glycerine, is detected by tinging the sample blue with sulphate of indigo, and then adding a little sulphuric acid; if free chlorine, or chloride of calcium, be present, the blue color will disappear.

If a few drops of a solution of nitrate of silver be added to glycerine, the presence of *chlorine* is marked by the formation of a white precipitate.

Oxalate of ammonia will precipitate *lime*, if present. *Lead* will be detected in the same way by hydrosulphate of ammonia; and *sulphuric acid* by a soluble salt of baryta.

Cane sugar may be traced by increased sweetness of taste; also by dissolving the glycerine in chloroform, in which it is completely soluble if pure, sugar being insoluble in it.

1152. Caution About Glycerine. The property which has caused most annoyance in the use of glycerine is its strong affinity for water. Although glycerine has a pleasant, sweetish taste, yet the first sensation that is felt when it is applied to the tongue is one of pain and burning. This is caused by the fact that the glycerine absorbs all the moisture from the surface that it touches, and thus dries it up and parches the nerves. Ignorant of this fact, nurses and mothers have applied pure glycerine to the chafed skin of infants, and produced great pain. The glycerine ought to have been first mixed with an equal bulk of water, or at least with so much as would remove its burning action on the sense of taste. This being done, it may be applied to the most tender surfaces without producing injury, and as it does not dry up, virtually maintains the parts in a constantly moist condition, excluding the air and promoting the healing process.

1153. Fine Glycerine Lotion. Glycerine, 3 fluid ounces; quince-seed mucilage, (*see next receipt*), 10 fluid drachms; pulverized cochineal, 5 grains; hot water, 1½ fluid ounces; inodorous alcohol, 2½ fluid ounces; oil of rose, 8 drops; pulverized gum-arabic; ½ drachm; water, 8 fluid ounces. Rub the powdered cochineal first with the hot water gradually added, and then add the alcohol. Then triturate the oil of rose well with the powdered gum-arabic, and gradually add the water as in making emulsion. (*See No.* 43.) With this mix well the solution first formed, and filter, and to the filtered liquid add the glycerine and mucilage of quince seeds, and shake well. The mucilage of quince seeds should always be freshly made. If the alcohol is sweet and free from foreign odor, and the glycerine perfectly inodorous, a less quantity of oil of rose may suffice. If care is taken in its manufacture, this will form a beautiful and elegant preparation, with a rich rosy fragrance. When applied to the skin it imparts an agreeably soft, smooth, and velvety feel. It is an excellent application for the face after shaving, or for allaying the irritation caused by exposure to the wind.

1154. Quince Mucilage. The mucilage of quince seeds may be made by boiling for 10 minutes 1 drachm quince seeds in ½ pint water, and straining. This is sometimes used as a bandoline, but it soon decomposes, and, therefore for that purpose, only very small quantities should be prepared.

1155. Gowland's Lotion. The formula sanctioned by the medical profession is to take of Jordan almonds (blanched), 1 ounce; bitter almonds, 2 to 3 drachms; distilled water, ½ pint; form them into an emulsion. To the strained emulsion, with agitation, gradually add of bichloride of mercury (in coarse powder), 15 grains previously dissolved in distilled water, ½ pint. After which further add enough water to make the whole measure exactly 1 pint. Then put it in bottles. This is used as a cosmetic by wetting the skin with it, and gently wiping off with a dry cloth. It is also employed as a wash for obstinate eruptions and minor glandular swellings and indurations.

1156. Lotion of Borax, for Sore Gums and Nipples. Take 5 drachms powdered borax; distilled water, ½ pint; mix. An effective wash for sore gums, sore nipples, excoriations, &c., applied twice or thrice daily, or oftener.

1157. Glycerinated Lotion of Borax for Chaps and Sunburns. Take 6 drachms avoirdupois powdered borax; Price's glycerine, ¾ ounce; rose-water or elder-flower water, 12 ounces; mix. Resembles the last, but is fragrant and much more agreeable and effective. Its daily use as a cosmetic wash renders the skin beautifully soft and white, and prevents and removes chaps, sunburns, &c.

1158. Cazenave's Lotion of Cyanide of Potassium. Take cyanide of potassium, 5 grains avoirdupois; emulsion of bitter-almonds, 3 Imperial fluid ounces; dissolve.

Used like the last, to allay itching and irritation, particularly after shaving; also for freckles and pustules. (*See No.* 43.) The above is Cazenave's formula. The next receipt is, however, preferable,

1159. Glycerinated Lotion of Cyanide of Potassium. Take cyanide of potassium, 6 grains avoirdupois; glycerine, ½ ounce; strongest camphor-water, 2½ ounces; mix. (*See No.* 1160.)

1160. Caution Against Cyanide of Potassium. Cyanide of potassium is highly poisonous when swallowed, and as the above lotions are pleasant-tasted, they should not be left out of the dressing-case; nor should a larger quantity than that above given be kept in use at once; nor, under ordinary circumstances, should they be applied to a large surface at a time. If not kept under lock and key, it is safest to label them *Poison.* Kept with care, and properly employed, they are safe and useful lotions.

1161. Cherry-Laurel Lotion, or Shaving Wash. Take genuine distilled cherry-laurel, 2 Imperial fluid ounces; rectified spirit, 1 fluid ounce; glycerine, ½ ounce; distilled water, 7½ fluid ounces; mix. Used to allay irritation of the skin, particularly after shaving, the part being moistened with it by means of the tips of the fingers; also used as a wash for freckles and pustules, and to remove excessive moistness or greasiness of the hair. Milk of bitter-almonds is often substituted for the glycerine and spirit, but not for the hair.

1162. Glycerine and Borax Lotion for the Complexion. Mix ½ ounce powdered borax, and 1 ounce pure glycerine, with 1 quart camphor-water. Wet the face morning and evening with this lotion, allowing it to dry partially, and then rinse off with soft water.

1163. Pomade de Ninon de l'Enclos. Take of oil of almonds, 4 ounces avoirdupois; hog's lard, 3 ounces; spermaceti, 1 ounce; melt, add of expressed juice of house-leek, 3 Imperial fluid ounces, and stir until the mixture solidifies by cooling. A few drops of esprit de rose, or of eau de Cologne, or lavande, may be added to scent it at will. Used as a general skin-cosmetic; also for wrinkles and freckles. It is said to be very softening, cooling, and refreshing.

1164. Pomade de Beauté; Pomade de Vénus. Take of oil of almonds, 1 pound; spermaceti (pure), 2 ounces; white wax (pure), 1½ ounces; glycerine (Price's), 1 ounce; balsam of Peru, ½ ounce; mix by a gentle heat, and stir the mass until it begins to solidify. It is sold either white, or tinted of a delicate rose or green color. Used both as a hair and skin cosmetic. It forms an elegant substitute for ordinary cold-cream, lip-salve, &c., and is much recommended by the makers for improving the quality and promoting the growth of the hair.

1165. Shaving Paste; Pate pour Faire la Barbe. Take of Naples-soap (genuine), 4 ounces; curd-soap (air-dried and powdered), 2 ounces; honey (finest), 1 ounce; essence of ambergris (or essence royale), oil of cassia, oil of nutmeg, of each 10 drops; beat them to a smooth paste with water or eau de rose; and put it into covered pots. (*See Nos.* 602, *&c., and* 607.)

1166. Shaving Paste. Take of white soft-soap (*see No.* 600), 4 ounces; honey-soap (finest, sliced), 2 ounces; olive-oil, 1 ounce; water, 1 or 2 table-spoonfuls; carbonate of soda, 2 drachms; melt them together, and form a paste, as before, adding a little proof spirit and scent, at will. Some persons melt with the soap about 1 drachm of spermaceti.

1167. Colored Collodion for the Skin. 1 ounce collodion, 3 grains each pure annotto and dragon's blood; digest, with agitation, in a stoppered phial, for 24 hours; and, if necessary, decant the clear portion.

1168. Flesh Colored Collodion. 2 ounces collodion; 1 drachm palm oil; alkanet, 15 grains; digest, &c., as in the last receipt. This dries of a good skin color; but it is not so strong as the product of the preceding formula.

1169. Glycerinized Collodion may be obtained by substituting 2 drachms of glycerine for the palm oil in the preceding receipt. This is exceedingly supple, does not crack or scale off from the skin, and accommodates itself to the motions of the part.

1170. Peruvian, or Red Lip Salve. Take of spermaceti ointment, ½ pound; alkanet root, 3 or 4 drachms; digest, at a gentle heat, until the first has acquired a rich deep red color, then pass it through a coarse strainer. When the liquid fat has cooled a little, stir in thoroughly 3 drachms balsam of Peru. In a few minutes pour off the clear portion from the dregs (if any), and add 20 to 30 drops oil of cloves. Lastly, before it cools, pour it into the pots or boxes. The product forms the finest and most esteemed *lip salve.* 2 or 3 drops of essence of ambergris, or of essence royale, improve and vary it.

1171. Rose Lip Salve. As the above, but using only 1½ drachms balsam of Peru, and replacing the oil of cloves with a few drops of attar of roses, or sufficient to give the mixture a marked odor of roses. Some makers omit the balsam altogether. If uncolored, it forms white rose lip salve. (*See No.* 1135.

1172. White Lip Salve. Take ½ pound spermaceti ointment, liquify it by the heat of warm water, and stir in ½ drachm neroli or essence de petit-grain as before.

1173. Glycerine Lip Salve. This is prepared by adding ⅙ to ⅛ part of glycerine to any one of the above whilst in the melted state, and stirring the mixture assiduously until it begins to cool.

1174. French Lip Salve. Mix together 16 ounces lard, 2 ounces white wax, nitre and alum in fine powder, of each, ½ ounce; alkanet to color.

1175. German Lip Salve. Butter of cacao, ½ ounce; oil of almonds, ¼ ounce; melt together with a gentle heat, and add 6 drops essence of lemon.

1176. Gants Cosmétiques. These are white kid gloves, which have been turned inside out, and brushed over with a melted compound of wax, oil, lard, balsam, &c. The Peruvian lip salve (*see No.* 1170) without the alkanet, may answer the purpose. An excellent method for softening the hands.

Washes for Failing Hair or Baldness. Liniments or washes to make the hair grow, can always be employed, with greater or less success, so long as there is any vitality left in the hair follicles or roots. If, however, these are entirely dead or destroyed, there is no possibility of inducing a fresh growth of hair. This will be evident from the shining or glistening appearance the scalp assumes when the hair roots are destroyed. The loosening of the hair, which frequently occurs to young persons, or those of the middle period of life, will generally, if neglected, become real baldness. Such a state is common in women, and generally terminates, in its mildest form, in excessive loosening of the hair. The case, however, is not the hopeless one which is generally imagined; and if proper treatment be pursued, the hair will grow afresh, and assume its pristine strength. A useful practice in men, and those of the opposite sex whose hair is short, is to immerse the head in cold water morning and night, dry the hair thoroughly, and then brush the scalp, until a warm glow is produced. For women with long hair, this plan is objectionable; and a better one is to brush the scalp until redness and a warm glow are produced, then dab among the roots of the hair one or other of the hair lotions. If the lotion produce smarting or tenderness, the brush may be laid aside, but if no sensation is occasioned, the brushing should be resumed, and a second application of the lotion made. This treatment should be practiced once or twice a day, or at intervals of a few days, according to the state of the scalp; namely, if tender, less; if insensible, more frequently. When the baldness happens in patches, the skin should be well brushed with a soft tooth brush, dipped in distilled vinegar morning and evening, or dipped in one of the washes given below. If either of these lotions should be found too irritating to the skin, use them in smaller quantity, or diluted, and less frequently. If they have the effect of making the hair harsh and dry, this inconvenience may be removed by the use of oil or pomatum after each application of the lotion. Pomatums for the growth of the hair are very inferior to the lotions in efficacy. The basis of most hair invigorators and restorers is either the tincture or the vinegar of cantharides; the method of preparing the latter ingredient is given in the next receipt.

1178. To Prepare Vinegar of Cantharides. This preparation is not always obtainable in the drug stores, and is made by macerating, with agitation for 8 days, 2 ounces powdered cantharides in 1 pint acetic acid; then press and strain.

1179. Wash for Restoring Hair. Mix ½ ounce vinegar of cantharides with 1 ounce eau de Cologne and 1 ounce rose water. Or, ½ ounce tincture of cantharides, 2 ounces eau de Cologne, ½ drachm oil of nutmeg, and 10 drops oil of lavender.

1180. Morfit's Hair Tonic. Scald black tea, 2 ounces, with 1 gallon boiling water; strain, and add 3 ounces glycerine; tincture cantharides, ½ ounce; and bay rum 1 quart. Mix well by shaking and then perfume.

1181. Regenerative Glycerine Hair Wash. Take 1 ounce, avoirdupois, glycerine (Price's); strongest eau de Cologne, ¼ Imperial pint; liquor of ammonia (specific gravity 880-882), 1 fluid drachm; oil of origanum and oil of rosemary, each, ½ fluid drachm; tincture of cantharides, 1 fluid ounce; briskly agitate them together for 8 or 10 minutes, then add ½ pint strongest camphor water, and again well agitate. A few drops of essence of musk are often added. An excellent hair lotion, and one that supersedes the necessity of using oil or pomade.

1182. Erasmus Wilson's Hair Wash. Take 8 Imperial fluid ounces strongest eau de Cologne; tincture of cantharides, 1 fluid ounce; English oil of lavender, and oil of rosemary, each, ½ fluid drachm; mix. It is improved by the addition of ½ fluid drachm oil of origanum, or by its substitution for the oil of lavender; but the omission of the latter renders it less odorous.

1183. Parisian Wash to Gradually Darken the Hair. Take of green sulphate of iron, 15 to 20 grains; distilled verdigris, 5 or 6 grains; good white wine, ¼ Imperial pint; perfume with eau de Cologne to suit; mix. A favorite among the fashionable Parisians. The above will iron-mould linen if permitted to come in contact with it.

1184. Wash to Gradually Darken the Hair. Take of sulphate of iron (green, crushed), 2 drachms avoirdupois; rectified spirit, 1 Imperial fluid ounce; oil of rosemary, 10 or 12 drops; pure soft water, ½ pint; agitate them together until solution and mixture are complete. Many persons substitute the strongest old ale for the water ordered above. (*See No.* 1183.)

1185. Wash to Darken the Hair. Take of rust of iron, 2 drachms avoirdupois; old ale (strongest), 1 Imperial pint; oil of rosemary, 12 to 15 drops; put them into a bottle, very loosely cork it, agitate it daily for 10 or 12 days, and then, after repose, decant the clear portion for use. (*See No.* 1183.)

1186. Wash for Dry, Stubborn Hair. The best and most effective of these consists of 1½ ounces avoirdupois glycerine dissolved in 1 Imperial pint of any fragrant distilled water, as that of roses, or orange or elder flowers; 15 to 20 grains salt of tartar (carbonate of potassa) per pint, is sometimes added.

1187. Wash to Cleanse the Hair and Scalp. 1 tea-spoonful powdered borax; 1 table-spoonful spirits of hartshorn; 1 quart soft water. Mix all together and apply to the head with a soft sponge; then rub the head well with a dry towel. Use once a week.

Another excellent method of cleansing the hair, is to take the yolk of an egg, and rub it in thoroughly a little at a time. It will produce a slight soapy lather, which should be rinsed out with soft water. This leaves the scalp perfectly clean, and the hair soft and silky.

1188. Barbers' Shampoo Mixture. Shampooing is a term used for cleansing the head and hair. Salts of tartar (carbonate of potassa) is the principal article used by barbers for this purpose. Dissolve 1 ounce salts of tartar in 1 quart soft water; sprinkle freely on the head and rub well till a lather is formed; wash off with clean water. Bay rum can then be used if desired.

1189. Shampoo Liquor. Salts of tartar, 4 ounces; pulverized borax, 4 ounces; soft water, 1 gallon. Mix, and bottle for use.

1190. Fine Shampoo Liquor. This excellent wash for the hair is made by dissolving ½ ounce carbonate of ammonia and 1 ounce borax in 1 quart water, and adding thereto 2 ounces glycerine, 3 quarts New England rum, and 1 quart bay rum. The hair, having been moistened with this liquor, is to be shampooed with the hands until a slight lather is formed; and the latter being then washed out with clear water, leaves the head clean, and the hair moist and glossy.

1191. Hair Curling Liquid. Take borax, 2 ounces; gum-arabic, 1 drachm; add hot water (not boiling), 1 quart; stir, and as soon as the ingredients are dissolved add 3 table-spoonfuls strong spirits of camphor. On retiring to rest wet the hair with the above liquid, and roll it in twists of paper as usual.

1192. Curling Fluid for the Hair. Take 1 ounce avoirdupois finest white gum-arabic; good moist sugar, ½ ounce; pure hot water, ¾ Imperial pint; dissolve. To the solution, when cold, add 2 fluid ounces rectified spirit; corrosive sublimate and powdered sal-ammoniac, each 6 grains; the last two being dissolved in the spirit before admixture. Lastly, add enough water to make the whole measure 1 pint, with a little esprit de rose, eau de Cologne, or eau de lavande, to scent it. The hair is moistened with the fluid before putting it in papers or papillotes, or twisting it with the fingers. Shake before using.

1193. Wild Rose Curling Fluid. Take 2 drachms avoirdupois dry salt of tartar (carbonate of potassa); powdered cochineal, ½ drachm; liquor of ammonia and esprit de rose, each 1 fluid drachm; glycerine, ¼ ounce; rectified spirit, 1½ Imperial fluid ounces; distilled water, 18 ounces; digest, with agitation, for a week, and then decant or filter. The hair is moistened with it, and then loosely adjusted. The effect occurs as it dries.

1194. Drying Washes for Moist, Lax Hair. Take of essential oil of almonds. 1 Imperial fluid drachm; oil of cassia, ½ fluid drachm; essence of musk, ½ fluid drachm; rectified spirit, 2½ fluid ounces; mix, and add gradually, with brisk agitation, 16 avoirdupois ounces distilled water in which has been dissolved 1 ounce finest gum-arabic. The hair and scalp are slightly moistened with the liquid, and the hair at once arranged without wiping, whilst still moist. Shake before using.

1195. Rose Bandoline. Steep 6 ounces gum tragacanth for 30 hours in 1 gallon rosewater, stirring frequently; strain through a cloth, and let it stand for a few days; then strain again and work into it 4 drachms oil of roses. (*See No.* 1154.)

1196. Hair Gloss. Mix 1 pint spirit of jasmin, and 5 drops aniline, with 4 pounds pure glycerine.

1197. How to Dry a Lady's Hair. The lady should recline on a lounge or a sofa, with her long hair hanging over the end. A pan containing 2 or 3 bits of ignited charcoal is then placed under it, and a little powdered benzoin sprinkled upon the lighted fuel. The thick smoke which rises and is strongly impregnated with benzoic acid combined with carbonic acid, rapidly absorbs the moisture in the hair, which should be previously well wiped with towels, so as to be as free from wet as possible; and in a few seconds the hair is perfectly dry, beautifully perfumed, and ready for the operation of the brush.

Hair Dyes.

The numerous preparations vended, under different names, as hair dyes, have generally a basis of lead or silver, and possess a sameness of composition which scarcely occurs, to an equal extent, in any other class of cosmetics. A few, it is true, contain bismuth, crude pyrogallic acid, and certain astringent vegetable juices, as their active ingredients; but these are only occasionally met with in the stores.

1199. Walnut Hair Dye. The simplest form is the expressed juice of the bark or shell of green walnuts. This is the venerable hair dye of Paulus Ægineta. To preserve this juice, a little rectified spirit is commonly added to it, with a few bruised cloves, and the whole digested together, with occasional agitation, for a week or fortnight, when the clear portion is decanted, and, if necessary, filtered. Sometimes a little common salt is added with the same intention. It should be kept in a cool place.

1200. Pyrogallic Hair Dye. Take of pyrogallic acid, ¼ ounce; dissolve it in hot distilled water, 1½ ounces; and, when the solution has cooled, gradually add of rectified spirit, ½ fluid ounce. It may be made a little stronger or weaker at will.

1201. Beautiful Black Hair Dye. This is composed of 2 different liquids. Take 6 drachms avoirdupois good recent sulphuret of potassium; distilled water, 2 Imperial fluid ounces; liquor of potassa, 1½ drachm; agitate them together, after repose decant the clear solution into a stoppered phial, and label the bottle either *Solution No.* 1, or *The Mordant.* (*See No.* 93.) This solution does not stain the skin, and is an effective and easily prepared mordant. In some of the mordants sold in the shops, the liquor of potassa is omitted. To prepare the dye, next take 3 drachms avoirdupois crystals of nitrate of silver; distilled water, 2 Imperial fluid ounces; dissolve in a stoppered phial, and mark it either *Solution No.* 2, or *The Dye.* This is the average strength of the best silver-dyes of the stores. The strongest, intended to dye the hair black, in a few cases are made with 2 drachms of the nitrate to 1 fluid ounce of distilled water; weaker ones, for brown, with only 1 drachm of the nitrate to the fluid ounce. This solution stains the skin as well as the hair. These solutions are usually put up in flat stoppered phials, and one of each, handsomely labeled, sold together in a case under various fanciful names, for which a most extravagant price is generally charged. They form the most convenient, effective, and expeditious hair dye known, and the one now chiefly sold and used by the large perfumers and hair-dressers. Other nearly similar mordants are recommended by different good authorities. A good formula is:—Take of liquor of potassa, 3 fluid drachms; hydrosulphuret of ammonia, 7 fluid drachms; distilled water, 1 ounce; mix. The method of using these liquids is given in the following receipt:

1202. Method of Using the Hair Dye. The hair (perfectly clean) is first thoroughly wetted to the roots with *Solution No.* 1, previously diluted with 4 or 5 times its bulk of pure water, or of the highest strength that can be used without irritating the skin, care being taken not to make the hair too wet, as that would interfere with the next operation. A small brush is commonly used for the purpose, and the action and absorption of the mordant is promoted by the free application of the former for a short time. After the lapse of 2 to 5 minutes, the hair is thoroughly but lightly moistened with the dye, or *Solution No.* 2, by means of a small-toothed comb, or what is more convenient, a half-worn tooth brush, care being taken to touch the skin as little as possible. Any stains left on the skin by accidental contact with the dye, are now removed by rubbing them with a piece of rag or sponge, or the corner of a napkin wetted with a little of the mordant previously diluted with water. After the lapse of a few minutes, the skin is sponged clean with a little warm water, and wiped dry, and the hair arranged with the comb, in the usual manner. It is better to avoid rubbing or washing the hair for a few hours. Sometimes the two operations are reversed, and the dye applied first. The color thus produced is more permanent, but stains on the skin are less easily removed. The whole process, if expertly managed, may be completed in from 10 to 15 minutes.

1203. Hydrosulphate or Hydrosulphuret of Ammonia (also called sulphuret or sulphide of ammonia), used as a mordant in dyeing the hair with either silver or lead, may be prepared as follows:—Take of sulphur, 1 part; fresh dry hydrate of lime, 2 parts; boil in water sufficient to dissolve the sulphur; filter, and to the filtered liquid add for every 8 parts of sulphur used, 33 parts of sulphate of ammonia. After agitation and repose, the clear supernatant liquid must be decanted, and preserved in bottles. The product contains traces of lime, which do not, however, unfit it for use in the cosmetic art. When a salt of antimony is used to dye the hair, the neutral hydrosulphuret of ammonia should be employed, as, if the liquid contain more sulphur than is necessary to neutralize the ammonia, and it be used in excess, the color at first produced is dissolved out and washed away. But if this excess be avoided, the bisulphuret gives the brightest color. The neutral hydrosulphuret is prepared by saturating strong liquor of ammonia with sulphuretted hydrogen, and then adding a second portion of liquor of ammonia equal to that first used. (*See No.* 1201.)

1204. Red Hair Dye. An acidulated solution of a salt of antimony (a solution of potassio-tartrate of antimony or tartar-emetic 1 to 16, acidulated with a little tartaric, citric, or acetic acid, may be used), followed by a weak mordant of neutral hydrosulphuret of ammonia (*see No.* 1203), or the bisulphuret (carefully avoiding excess) gives a red turning on the orange, which tones well on light-brown hair. A solution of sulphantimoniate of potassa (Schlippe's salt) with a mordant of water slightly acidulated with sulphuric acid, gives a bright orange-red or golden-red color.

1205. Red Hair Dye. A strong infusion of safflowers, or a solution of pure rouge, in a weak solution of crystallized carbonate of soda, gives a bright red like henna, or a reddish yellow, according to its strength, if followed, when dry, by a mordant of lemon juice or vinegar diluted with one-half to an equal bulk of water.

1206. Blonde or Flaxen Hair Dye. Mix in 10 ounces distilled water, 1 ounce acetate of iron, 1 ounce nitrate of silver, and 2 ounces nitrate of bismuth; moisten the hair with this mixture, and, after an hour, touch it with a mixture of equal parts of sulphide of potassium and distilled water.

1207. Blonde Hair Dye. Another method is by moistening the hair with a mixture of 2 ounces protochloride of tin and 3 ounces hydrated lime. An hour after, use the potassium solution as in last receipt.

1208. Golden Yellow Hair Dye. A solution of bichloride of tin, sufficiently diluted, followed by a mordant of hydrosulphuret of ammonia (*see No.* 1203), gives a rich golden yellow tint to very light hair, and a golden brown to darker hair, owing to the formation of bisulphuret of tin.

1209. Rich Yellow Hair Dye. A solution of acetate or nitrate of lead, followed by a mordant of yellow chromate of potash, gives a brilliant rich golden yellow. If wanted warmer or deeper toned, a few drops of solution of diacetate of lead (Goulard's extract) should be added to the acetate solution.

A solution of pure annotto obtained by boiling it in water slightly alkalized with carbonate of soda, or with salt of tartar, gives a golden yellow or flame yellow, according to its strength, to very pale hair, and corresponding tones to darker hair. A previous mordant of alum-water deepens it, and a subsequent washing with water soured with lemon juice or vinegar reddens it or turns it on the orange.

1210. Brilliant Yellow Hair Dye. A solution of a neutral salt of iron (sulphate, acetate, or chloride), followed by a weak solution of carbonate of soda, or salt of tartar, or lime water, gives a warm yellow or nankeen color, which, when deep, turns on the red. In the latter case it is apt to assume a sandy shade on very light hair.

1211. Brown Hair Dye. A ready way to color the hair brown is by a solution of permanganate of potassa in the proportion of 1 troy ounce to 1 quart of water. The hair must be first cleansed by a dilute solution of ammonia, when it is dried by means of a towel, and the solution of the permanganate applied to the hair, but not to the skin, as this would also be colored. It dyes the hair immediately, and the desired shade may be obtained by applying more or less of the solution. Should the hands become stained with it, they can be cleaned with a little dilute hydrochloric acid. This dye is not permanent, but is very easily renewed with a tooth-brush.

1212. Golden Brown Hair Dye. Brown hair may have a golden tone imparted to it by the judicious application of any of the yellow dyes already noticed. Light hair may be previously dyed of a warm light brown before applying the latter. A solution of sulphate of copper (blue vitriol), followed by a solution of ferrocyanide of potassium, gives an extremely rich golden brown or bronze brown to light hair, when the process is expertly managed.

1213. Cautions about Applying Hair Dyes. The application of the above dyes, so as to produce appropriate and agreeable shades, requires more consideration and experience than that of the black dyes. The complexion, and the natural color of the hair of the person operated on, with other attendant circumstances, must be carefully considered beforehand, and allowed for. Unless all these points be attended to, the party may, on looking in the mirror, suddenly find himself strangely altered in appearance, and probably for the worse. Hair dyes of all kinds will only act effectively and satisfactorily on perfectly clean hair. The presence or the slightest contamination of oily or greasy matter will arrest or greatly lessen their action, and render it unequal in different parts. Hence the hair, in all cases, should be first thoroughly washed with warm soap and water, then rinsed with tepid water, and lastly, wiped dry previous to their application. A few grains of soda or of salt of tartar (carbonate of potassa) added to the first water, will facilitate its detergent action

1214. To Bleach Hair. It has been found in the case of bleaching hair that gaseous chlorine is the most effectual. The hair should be cleaned for this purpose by a warm solution of soda, and washed afterwards with water. While moist it is put into a jar and chlorine gas introduced, until the air in the jar looks greenish. Allow it to stand for 24 hours, and if necessary repeat the operation. The employment of binoxide of hydrogen has been often recommended for this purpose, it being in every way superior to the other agents, but it has the drawback of being difficult to prepare.

1215. Lotions to Change the Color of the Hair. A number of lotions are extensively advertised, and sold under the name of "Hair Restorers," "Hair Rejuvenators," "Life for the Hair," &c., which purport to restore the color and improve the growth of the hair. The active agent in all these preparations is lead, combined with sulphur, and this, by frequent application, darkens the hair. In the majority of cases, probably, a moderate use of such a lotion would be unattended with mischief; but it is worth remembering that palsy has been known to be produced by the long continued use of cosmetics containing lead. The following receipts show how these *restorers* are made :

1216. Hair Coloring which is not a Dye. Take 1 drachm lac sulphur; sugar of lead, 2 scruples; glycerine, 2 ounces; distilled water, 6 ounces; mix, and perfume to fancy. Or, lac sulphur and sugar of lead, each 1 drachm; sulphate of iron (copperas), 10 grains; glycerine, 2 ounces; water, 6 ounces; mix and perfume. Shake well before using, and apply with a sponge every other day until a change of color is obtained, after which one application each week will be sufficient. The hair must be cleansed of all greasy matter before using the above. (*See No.* 1213.)

1217. Magic Hair Colorer and Restorer. Take of sugar of lead, ½ ounce; lac sulphur, 3 drachms; aqua ammonia, 1½ ounces; glycerine, 6 ounces; water sufficient to fill a pint bottle; mix, and perfume to suit the fancy. Or, take of lac sulphur and sugar of lead, each 1 drachm; tinctures of capsicum, and cantharides, each ½ ounce; glycerine, 2 ounces; water, 5 ounces. Apply as above. Do not employ any greasy oils in perfuming these preparations. (*See No.* 1213.)

1218. Hair Restorative. Take 1 drachm milk of sulphur, 1 drachm acetate of lead, 2 drachms muriate of soda, 2 fluid ounces glycerine, 8 fluid ounces bay rum, 4 fluid ounces Jamaica rum, and 1 pint water. Mix together, and shake before using.

Depilatories. Preparations for removing superfluous hair from the skin. The constituents of most of these are lime, and the tersulphuret of arsenic (orpiment), but the use of orpiment is dangerous, especially in case of any abrasion of the skin. The safest depilatory is a strong solution of sulphuret of barium made into a paste with powdered starch. It should be applied immediately after it is mixed, and allowed to remain there for 5 or 10 minutes. (*See Nos.* 1223 *to* 1225.)

1220. Martin's Depilatory. Apply a light coating of sulphuretted sulphide of calcium to the part from which the hair is to be removed; after 10 minutes it may be washed off, and the skin will be clean.

1221. Boudet's Depilatory. Mix 3 parts hydro-sulphuret of sodium (crystallized), 10 parts finely powdered quicklime, and 11 parts starch. It should not be applied longer than 2 to 4 minutes. Very effective and safe.

1222. Chinese Depilatory. Mix 8 ounces quicklime, 1 ounce dry pearlash, and 1 ounce sulphuret of potassium; apply as in the last receipt.

1223. To Apply a Depilatory as a Paste. In use, the chemical depilatories (*see Nos.* 1219 *to* 1222) which are in the state of powder, are made into a paste with warm water, and immediately applied to the part, previously shaved close, a little starch being generally added to those which do not contain it, in order to render the paste more manageable. Sometimes soap-lye is used, instead of water, to form the paste. A wooden or bone knife should be used in preparing this paste.

1224. To Apply a Depilatory as a Plaster. Another mode of application is to make the paste rather thick, spread it on a piece of strong paper, and apply it like a plaster. In from 5 to 10 or 15 minutes, or sooner if much smarting occurs, the paste should be washed off with warm water, and a little cold cream or any simple ointment applied to the part. The liquid depilatories are usually thickened with a little starch powder, before application. (*See Nos.* 1219 *to* 1222.)

1225. Cautions About Applying Depilatories. Both classes (*see Nos.* 1223 *and* 1224) require caution in their use. They should be applied to only a small surface at a time, and great care should be taken to prevent them extending to the adjacent parts. They lose their properties unless kept entirely excluded from the air; and no liquid must be added to the dry ones until just before their application, and then no more should be mixed than is required for immediate use.

Scented Oils; Perfumed Oils.

The fixed oil that usually forms the basis of the simple scented oils of the perfumer, is that of almonds, ben, or olives; but other bland vegetable oils are occasionally used, particularly for inferior qualities. In France, three different modes are adopted for imparting fragrance to these oils.

1227. **Perfumed Oils by the Addition of Essential Oils, or Alcoholic Essences.** By the simple addition of a sufficient quantity of the essential oil of the plant, or of the concentrated alcoholic essence of the substance, if it does not furnish an oil, followed by agitation; the whole being then allowed to repose for a few days, and, if any sediment falls (which should not be the case if the ingredients are pure), the clear portion decanted or poured off into another bottle. In the case of alcoholic essences, it is better that the fixed oil should be gently warmed by placing the bottle or vessel (a well-tinned bottle or can with a suitable mouth and neck for corking, is the best and most convenient for the purpose,) for a short time in a water-bath, before adding them, and then, after tightly and firmly securing with a cork, to agitate it until cold or nearly so. In general, 1 to 1½ drachms of a pure essential oil, or 3 to 4 fluid drachms of a concentrated essence, is sufficient to render 1 pint of fixed oil agreeably fragrant; but in some cases, and for the best quality, an additional ½ drachm, or more, of the one, and 1 to 2 fluid drachms of the other, will be required. ½ drachm pure attar of roses, owing to the very powerful character of its odor, is sufficient for the purpose. Oils of ambergris, bergamot, cassia, cinnamon, cloves, lavender, lemons, millefleurs, musk, neroli, nutmeg, orange-flowers, roses, and all other similar scented oils, may be thus made. The above are chiefly employed as hair cosmetics, with, in most cases, trifling additions of other essential oils or essences, to modify and improve their odor. Some of them are also colored. (*Cooley.*)

1228. **Perfumed Oils by Infusion.** "Dry substances, after being reduced to coarse powder (but free from dust), or sliced very small; flowers or petals, after being carefully selected, picked from the stems and other scentless portions, and pulled to pieces; and soft, unctuous, and resinous matters, as ambergris, musk, civet, resins, and balsams, after being rubbed to a paste with a little of the oil (either with or without the addition of about twice or thrice their weight of clean siliceous sand or powdered glass, to facilitate the reduction), are digested in the fixed oil, for an hour or two, in a covered vessel, at a gentle heat obtained by means of a water-bath, frequent stirring or agitation being employed all the time. The vessel is then removed from the bath, and set aside (for flowers) until the next day, or (for other substances) for 5 to 7 days, to settle, when the clear portion is carefully decanted into a clean bottle, or bottles. With ambergris, civet, musk, and vanilla, the digestion, with frequent agitation, is usually continued for at least 3 weeks; and exposure of the vessel in the sun, or in some equally warm situation, is generally substituted for the heat of a water-bath. When flowers are employed, the free oil is allowed to drain off, and the remainder is obtained by the action of a press. The two portions being mixed, fresh flowers are added to the oil, and the whole process is repeated; and this again, with fresh flowers, 5 or 6 times, or oftener, until the oil is sufficiently fragrant." (*Cooley.*) For the extraction of perfume from rose leaves, from scented woods, from bark, from gums, there appears to be nothing better than glycerine, and this use of it is constantly on the increase, as the most delicate odors are perfectly preserved in it.

1229. **Perfumed Oils by Enfleurage.** A series of shallow iron frames, adapted for piling on each other, and fitting close together, being provided, a piece of white, spongy cotton-cloth is stretched upon each, and is then freely moistened with oil of almonds, olives, or ben. On the cloth is next laid a thin layer of the fresh-plucked flowers, and each frame, as thus covered, is placed on the preceding one, until a compact pile of them is raised. In 24 to 30 hours the flowers are replaced by fresh ones; and this is repeated every day, or every other day, until 7 or 8 different lots of flowers have been consumed, or the oil has become sufficiently charged with their odor. The cotton-cloths are then carefully collected and submitted to powerful pressure, and the expressed oil which flows from them is placed aside in corked bottles or jars, to settle. After some time it becomes perfectly clear, and is then ready to be decanted into other bottles for store or sale. Sometimes trays with perforated bottoms, on which are laid thin layers of cotton-wool slightly moistened with the oil, are substituted for the frames and cotton-cloth above referred to. Sometimes, also, sheep's wool or cotton wool impregnated with oil, is stratified with flowers in a large earthen vessel, and this, after being closely covered up, is kept for 10 or 12 hours gently heated by means of a water-bath. The next day the old flowers are replaced by fresh ones, and the whole process repeated again and again, as often as necessary. The oil is finally obtained by pressure from the wool, as before. When only a moderate degree of aroma is required in the oil, the flowers may be crushed in a mortar or a mill, with one-half their weight of blanched sweet almonds, and the next day, or the second day after, according to the weather, the mass, after being slightly warmed, may be submitted to the press. After about a week's repose, the upper portion, which is the perfumed oil, may be decanted, and, if necessary, filtered. This plan is occasionally adopted in this country for "Oil of Roses," and a few other flowers, intended for the hair. (*Cooley.*)

1230. **To Perfume Hair Oils.** The mixtures of essential oils, and other odorous substances, used in the preparation of the perfumed spirits, will furnish examples which may be followed in scenting hair oils and pomades, and from these can be framed other combinations as the fancy may suggest. (*See Nos.* 1243 and 1261.)

1231. Colorless Hair Oils. In preparing colorless or white hair oils, blanched fixed oil, and new and colorless, or nearly colorless, essential oils and essences only are employed.

1232. Colored Hair Oils. The colored oils derive their hues from the fixed oil of which they are prepared being tinged before the scent is added. In each case the colored oil should be allowed to clarify itself by repose in a closed vessel and a warm situation (60 to 70° Fahr.) before being decanted for further treatment. It is also better to pass it through a piece of coarse muslin, to remove floating particles; and, in some cases, it may be necessary to filter it, to render it quite brilliant—a quality which it should always possess.

1233. To Color Hair Oil Red or Crimson. A red and crimson tinge may be given by steeping, for 2 or 3 days, a little alkanet-root (say 2 or 3 drachms) in each pint of the oil. By warming the oil, the time required for obtaining the desired tinge may be reduced to 1 or 2 hours.

1234. To Color Hair Oil Yellow or Orange. A yellow and orange tinge may be given by rubbing up a little annotto with a portion of the oil whilst hot, and then adding it to the rest at a gentle heat; or, more simply, by adding a little bright palm oil to it whilst warm.

1235. To Color Hair Oils Green. A green tinge may be given by steeping a little green parsley, or spinach-leaves, or lavender, in the oil for a few days, in the cold; or by dissolving 2 or 3 drachms of gum-guaiacum in each pint of it, by the aid of heat.

1236. Oil of Musk; or Huile Musquée. Take 2 avoirdupois drachms grain-musk; ambergris, 1 drachm; oil (almond, olive, or ben), 1 Imperial pint; proceed by infusion. (*See No.* 1228.) Some makers add about 20 or 30 drops oil of lavender (English), 10 drops oil of cloves, and 5 or 6 drops oil of cassia, with the musk. A second quality is made by working over the same ingredients with ¾ pint of fresh oil.

1237. Oil of Ambergris and Musk; or Huile Royale. Take 4 drachms ambergris; grain-musk, 1 drachm; oil of lavender (English), 20 drops; oil of cassia, oil of cloves, oil of nutmeg, and neroli, each 10 drops; and proceed by infusion. (*See No.* 1228.) Very fine. The ingredients may be worked over a second time, as with oil of musk.

1238. Oil of Storax. Take 10 to 12 drachms pure liquid storax; oil of nutmeg, 12 to 15 drops; ambergris, 5 or 6 grains; oil (almond, olive, or ben), 1 Imperial pint; by infusion. (*See No.* 1228.) Highly fragrant. Used in the same way as oil of balsam of Peru.

1239. Oil of Vanilla; or Huile à la Vanille. Take 2½ ounces avoirdupois finest vanilla in powder; oil of bergamot, 1 Imperial fluid drachm; attar of roses, 15 drops; ambergris, 3 grains; oil (almond or olive), 1¼ pints; by infusion. (*See No.* 1228.) Very fragrant. For the simple oil, the bergamot, attar, and ambergris, are omitted.

1240. Oil of Ambergris; Huile d'Ambergris, or Huile à l'Ambre. Take of finest ambergris, 4 to 6 drachms avoirdupois; and oil (almond, olive, or ben), 1 Imperial pint; and proceed by infusion. (*See No.* 1228.) A second quality is made by working the residuum with ½ pint of fresh oil.

1241. Oil of Balsam of Peru. Take ½ avoirdupois ounce pure balsam of Peru, and hot oil of almonds, ¼ Imperial pint; agitate them together until perfectly mixed, and for a short time afterwards; then set the bottle aside, and in a few days decant the clear portion. Oil of nutmeg, 20 or 30 drops, is commonly added to increase its action. Used to scent other oils and fats; also, by itself, to improve and restore the hair, for which it is in high repute among many persons.

1242. Oil of Benzoin. Take finest gum benzoin, 1 ounce avoirdupois, and oil of almonds, 1 Imperial pint; and proceed by infusion. (*See No.* 1228.) Used to convey the scent of benzoin to other oils; and also to prevent rancidity.

1243. Mixed Essential Oils, or Mixed Scents. The following are used as extemporaneous scent for smelling bottles, hair oil, pomades, esprits, &c.; for which purpose one or other of them is commonly kept at hand by the druggists. 1 ounce of any one of them, added to a pint of rectified spirit, produces an agreeable esprit or perfume for personal use. Oil of bergamot and lemon, of each 1 ounce; oil of lavender (English) and pimento, of each ½ ounce; mix. Or: To the last add of oil of orange peel, 2 drachms; oil of cloves, 1 drachm; mix. Or: Take oil of bergamot, lemon and orange peel, of each 3 drachms; essence de petit-grain, 2 drachms; oil of cloves, 1½ drachms; oil of cassia, 1 drachm; mix.

1244. French Huiles or Hair Oils. The huile antique au jasmin, aux fleurs d'oranges, à la rose, à la tuberose, à la violette, &c., &c., of the French perfumers, are simply one or other of the bland fixed oils, (almonds, olives, or ben), strongly scented with the oils (huiles) of the respective flowers, or some other preparation of them. (*See Nos.* 1236 to 1242.)

1245. Marrow Oil. Take clarified beef-marrow, 1½ ounces avoirdupois; oil of almonds, ¼ Imperial pint; melt them together, and scent the mixture at will. Held in high repute as a hair oil, by many. That of the small stores has seldom any marrow in it, but lard instead. The appropriate scents are the same as for bear's grease. It is generally tinged slightly yellow by means of a little palm-oil or annotto.

1246. Tonquin Pomade or Oil. Macerate for from 12 to 24 hours, ½ pound tonquin beans in 4 pounds melted fat or warm oil, and strain through fine muslin; when cold the grease will be found to have acquired a fine odor of the beans.

1247. Vanilla Pomade or Oil. This is prepared in the same way as for tonquin beans, by substituting ¼ pound of vanilla beans.

1248. Macassar Oil. Oil of ben, 1 gallon, oil of noisette, ½ gallon; strong alcohol, 1 quart; attar of rose, 2 drachms; attar of bergamot, 3 ounces; attar of Portugal, 2 ounces; and tincture of musk, 3 ounces; mix together, digest with alkanet root (for color), in a stoppered bottle for a week, then strain and bottle.

1249. Cheap Hair Oils. These are made of fixed oils (usually almond or olive oil), gradually receding in quality, scented with less attar, the deficiency being made up by a mixture of oil of rhodium, rosemary, and bergamot. A few drops of neroli, or oil of rose geranium, or a little huile au jasmin, with or without 2 or 3 drops oil of musk or huile royale, are occasionally added to improve and slightly modify the odor.

1250. Tricopherous. Castor oil, ½ pint; 95 per cent. alcohol, ½ pint; tincture cantharides, ½ ounce; oil of bergamot, 2 drachms. Color a pale pink with alkanet root. (*See No.* 1233.)

1251. Oil for Incipient Baldness. The commonest, and perhaps the most convenient and easily prepared cosmetic of the kind, is a mixture of equal parts of tincture of cantharides and olive oil or almond oil, simply agitated together, and shaken before use. A more effective and cleanly liquid preparation may be made by substituting proof spirit (or good rum) for the oil, and adding 1 to 1½ drachms of glycerine (Price's) to each ounce of the mixture, a corresponding increase being made in the proportion of the tincture, to compensate for this addition. This preparation imparts as much moisture and gloss to the hair as the former one, and is much more genial in its action on the scalp. Distilled water, or rosemary water, is often substituted for proof spirit. A still more active preparation is made of tincture of cantharides and glycerine only.

Pomatums or Pomades.

Any scented greasy matter of appropriate consistence, or any mixture of fats, used, or intended to be used, in dressing the hair, now commonly passes under the name of pomatum or pomade. The usual basis of ordinary pomatum or pomade for use in this climate, is either a mixture of 2 parts of hog's lard and 1 part of beef suet; or of 5 parts of lard and 2 parts of mutton suet; the fats being both previously carefully rendered or prepared, and then melted together by a gentle heat. The latter mixture is chiefly used for white pomatum or pomade. Essential oil, and other volatile matter used to scent this fat, should be added to it and stirred up with it, after it has somewhat cooled, but before it begins to solidify, in order to prevent loss. The unscented mixed fats form the plain pomade or pomatum of the perfumers. (*Cooley.*)

1253. To Purify Suet or Lard for Making Pomades. Suet or lard form the body of pomades; and that their quality may be unexceptionable, the rendered suet must be subjected to a purifying process, in order to fit it for use in perfumery. This is done by melting the rendered fat by the heat of a saline or steam bath in an enameled iron vessel, and adding to it, gradually, 1 ounce powdered alum and 2 ounces chloride of sodium (pure table salt) to every fifty pounds of fat under treatment. The heat is to be continued above 212° Fahr., until scum ceases to rise to the surface, which contains all the organic and other impurities, and must be skimmed off as fast as it is formed. The fat is then strained through bolting cloth into clean stone jars, and left to cool. It is next to be spread upon a circular stone slab, the top surface of which is slanting from the centre, (that is, slightly conical in form), and provided with a stone roller which is made to revolve by suitable gearing. As the roller, or muller, revolves over the fat, cold water is allowed to trickle upon it, and this dissolves the saline impurities remaining in the fat. After this the fat is heated until all water is expelled by evaporation. When cold, the fat will be found to be very white and pure, and in a condition to preserve its sweetness, and suitable for use with the most delicate odors.

1254. Method of Purifying Fat. Take 1 cwt. of perfectly fresh grease, either of lard or beef suet; cut the grease into small pieces, and pound it well in a mortar; when it is well crushed, wash it with water repeatedly, until, in fact, the water is as clear after withdrawing the grease as before it was put in. The grease has now to be melted over a slow fire, adding thereto about 3 ounces crystallized alum in powder, and a handful of common salt; now let the grease boil, but allow it to bubble for a few seconds only; then strain the grease through fine linen into a deep pan, and allow it to stand, to clear itself from all impurities, for about 2 hours. The clear grease is then again to be put into the pan, over a bright fire, adding thereto about 3 or 4 quarts rose water, and about 5 ounces powdered gum benzoin; it is allowed to boil gently, and all scum that rises is to be removed, until it ceases to be produced; finally the grease is put into deep pans, and when cold taken carefully off the sedimentary water; it is then fit for use, and may be kept for an indefinite period, without change or turning rancid. It will be observed that the principal feature in this process is the use of benzoin.

1255. To Perfume Melted Fat. In adding aromatics or perfumes to the melted fat, its temperature must be adapted to their relative degree of volatility. Essential oils and alcoholic essences, particularly the more delicate ones, are added at the lowest possible temperature compatible with their perfect union with the fat; whilst substances like the aromatic resins and balsams are better added to the fat more fully liquefied, aiding their solution and union by stirring the mass with a wooden, bone, or porcelain knife or spatula. With the latter, after the union is complete, it is often necessary to allow the mixture to repose for a short time, and to pour it off from the dregs before adding the essential oils and essences, and concluding the work. (*See No.* 1261.)

1256. To Finish off Pomades. In finishing off pomades two methods are adopted, according to the appearance it is desired they should have. Those which it is intended should be opaque and white, should be stirred or beaten assiduously with a knife or spatula until the fat begins to concrete, or has acquired considerable consistence, before potting it; but when it is desired that they should be transparent or crystalline, the clear liquid mass is poured into the pots or bottles, previously slightly warmed, and the whole is allowed to cool very slowly, without being disturbed, in a situation free from draughts of cold air. For the ordinary pomades a mixture of lard and suet is generally employed; for the harder ones, suet chiefly or wholly; or a little pure white wax or beeswax (according to the intended color of the product) is melted with the fat to increase its solidity. For white pomades, mutton suet is employed; for others, in general, beef suet. In those which are artificially colored, either may be used; but beef suet is preferable when either clearness or a crystalline appearance is desired. (*Cooley.*)

1257. Coloring Matters for Fat. It is often desirable, as a matter of taste, to tinge the prepared fat used for perfumery. The process given below is applicable to all fats, whether solid or fluid. Color may also be imparted by the addition of pigments in powder, but these are objectionable for pomade, hair oil, and creams. The coloring matter should be dissolved or steeped in the melting fat before scenting it. (*See No.* 1232.)

1258. To Color Fat Pink. Bruise 4 ounces alkanet root for every pound of fat used; melt the fat over a water-bath, add the bruised alkanet, and digest for several hours. Strain the mixture through bolting cloth, and allow the clear fluid fat to cool. This fat, now colored deep pink, is used as a coloring mixture; 1 ounce of it will be sufficient to color 1 pound of white fat, by simply melting them together.

1259. To Color Fat Yellow. A yellow coloring fat may be prepared as in the last receipt, by using, instead of the alkanet, 1 ounce of annotto to the pound of fat.

1260. To Color Fat Green. The same process followed in No. 1258, with fresh walnut leaves, will give a green coloring fat.

1261. Essences for Scenting Pomatums. Millefleur—oil of lemon, 3 ounces; essence of ambergris, 4 ounces; oil of cloves, 2 ounces, oil of lavender, 2 ounces. Cowslip—essence of bergamot, 16 ounces; essence of lemon, 8 ounces; oil of cloves, 4 ounces; oil of orange-peel, 2 ounces; oil of jasmin, 2 drachms; eau de bouquet, 2 ounces; oil of bitter almonds, 16 drops. For general use—essence of bergamot, 16 ounces; essence of lemon, 8 ounces; true oil of origanum and oil of cloves, each 2 ounces; oil of orange-peel, 1½ ounces. (*See Nos.* 1243 *and* 1255.)

1262. Pomades by Infusion. These are prepared by digesting the odorous substances in the simple pomade (*see No.* 1265), at a very gentle heat, for 2 or 3, to 8 or 10 hours, according to their nature, in the way already noticed under "Oils" (*see No.* 1228); observing to stir the mixture frequently, and to keep the vessel covered as much as possible during the whole time. 1 part of flowers, carefully picked and pulled to pieces, to 3 or 4 parts of pomade, are the usual proportions. The next day the mixture is again greatly heated, and, after being stirred for a short time, is thrown into a strong canvas bag, which is then securely tied, and at once submitted to the action of a powerful press. (This should have been previously made moderately warm. This is effected either by means of a steam-jacket, or by filling it with hot water. In the latter case, care should be taken to perfectly free it from water before use.) The whole operation is then repeated, several times, with fresh flowers, or other bulky odorous substance, until the pomade be sufficiently fragrant. This will require 3 to 6 times its weight in flowers. Lastly, in the case of flowers, the pomade is liquefied in a covered vessel, at a gentle heat, as before; and after sufficient repose to allow it to deposit adhering moisture, is poured off for stock, or is at once potted. *To obtain essences* the fat is treated with spirit, which combines with the essential oil, leaving the fat with still a strong odor of the flower. This latter forms the French pomade. The delicate perfume of some flowers is impaired by heat, and the process of absorption (*enfleurage*) is adopted. (*See No.* 1263.) The mode of proceeding with the aromatic barks, seeds, resins, balsams, &c., the duration of the infusion, and the proportions taken, are, for the most part, similar to those of the corresponding huiles or oils; but here the first two substances, and others of a like nature, are only bruised, ground, or sliced very small, and not reduced to actual powder before digestion, as pomades, unlike oils, cannot be freed from fine powder or dust by filtration through fine media, or by repose in the cold. In this way are prepared the pomades of balsam of Peru, benzoin, cassia, cinnamon, lavender (green), orange-blossoms, orris-root (violet), roses (colored), storax, vanilla, and several others, kept by the French perfumers, and known and spoken of in this country by their French names, as "Pomade aux Fleurs d'Oranges," "à la Rose," "à la Vanille," &c. (*Cooley.*) Piesse proposes a simple method by which any person can perfume pomade in small quantities; and, if desired, prepare perfumed extracts of favorite flowers. Procure an ordinary, perfectly clean, double glue-pot, the inner vessel capable of holding a pound of fat. When the flowers are in bloom, put a pound of fine lard into the inner vessel of the glue-pot; pour sufficient boiling water into the outer pot, and place the whole on a stove until the lard is melted; strain it through a close hair-sieve into a vessel containing cold spring water. In order to obtain a perfectly inodorous grease, this process may be repeated 3 or 4 times, using each time fresh water, containing a pinch each of salt and alum. Lastly melt the purified fat and let it cool, to free it from water. Next put the fat in a vessel in a place just warm enough to keep it constantly liquid; throw into it as many of the flowers as it will receive; every 24 hours for a week, strain the fat from the flowers, and add fresh ones. This repetition of fresh flowers will produce a highly perfumed pomade. In this manner either one kind of flowers, or a mixture of 2 or more kinds may be employed. The perfumed extract may be obtained from the pomade by introducing the cold perfumed fat, finely chopped, into a wide-necked bottle, and covering it with the strongest spirits of wine that can be obtained; and, after closing the bottle, let it stand for a week, when the spirit may be strained off, and will be a perfumed extract of the flowers employed. The following flowers are best adapted for this process: Rose, jasmin, orange, violet, jonquil, tuberose, and cassia. Piesse proposes heliotrope, but probably without sufficient grounds.

1263. Pomades by Enfleurage. These perfumed pomades are prepared by a similar process to that adopted for the corresponding oils. (*See No.* 1229.) On the large scale, a layer of simple pomade is spread, with a bone palette-knife, on panes of glass, to about the thickness of a finger, and the surface is closely stuck all over with the newly-gathered flowers. The panes are then placed in shallow frames of wood, and these are closely piled one upon another, in stacks, in a moderately cool situation. In some of the great perfumeries of France, many thousands of these frames are employed at once. On the small scale, porcelain or pewter plates are generally used instead of panes of glass, and are inverted over each other, in pairs, so as to fit close at the edges. In each case the flowers are renewed daily, and the fat stirred up and re-spread occasionally, for 1, 2, or even 3 months, or until the pomade has become sufficiently fragrant to render it of the quality intended by the manufacturer. It is now scraped off the panes or plates, into the store-pots, and is ready for use or sale. In this way are prepared the finest qualities of cowslip, honeysuckle, jasmin, jonquil, may-blossom, myrtle-blossom, narcissus, orange-flower, tuberose, and violet pomade; as well as the pomades of several other delicate flowers that readily impart their odor to fat by simple proximity or contact. The imported pomades of this class, like those of the last one, are always distinguished among the perfumers, by their French names; as "Pomade au Jasmin," "Pomade aux Fleurs d'Oranges," "Pomade à la Violette," &c. The stronger pomades of these last two classes are chiefly employed in the preparation of extraits and essences, and are added to other pomades, to impart the fragrance of the respective flowers. The others are also used as hair cosmetics. (*Cooley.*)

1264. Mixed Pomades; Compound Pomades. These are prepared either by the admixture of the different fragrant pomades already noticed, or by the addition of judicious combinations of the more esteemed essential oils, essences, and other odorous substances, to simple pomade, whilst in the liquid or semi-liquid state. The latter is the method almost exclusively adopted by our perfumers. The usual fatty basis of the preceding pomades is one or other of the following:

1265. Plain Pomatum or Pomade. Take 2 parts carefully rendered hog's lard, and 1 part beef-suet (*see No.* 1253, *&c.*), and melt them together by a very gentle heat. The product is of the proper consistence for temperate climates. Or: Lard, 5 parts, and mutton-suet, 2 parts. (*See No.* 1253.) Or: Lard and suet equal parts.

1266. Common Pomatum. Take of plain pomade (or fat), 1 pound, melt it at the lowest degree of heat that will effect the object, add of oil of bergamot and lemon, of each 1 drachm; stir the mixture until it begins to concrete, and then pour it into the pots or bottles. This forms the ordinary pomatum.

1267. Rose Pomade. Melt together and mix in a water-bath 1 pound prepared grease and 2 ounces spermaceti; triturate in a mortar until it becomes white and smooth, then add and incorporate thoroughly 3 ounces oil of sweet almonds, ¼ drachm oil of roses, and ¼ drachm oil of geranium. A rose-color is obtained by heating the oil of almonds and adding to it ½ drachm of alkanet, and straining it before incorporation.

1268. Pomade Millefleur. This much esteemed pomade is strongly scented with several perfumes of the kind noticed below, so proportioned to each other that none predominate. The following are common examples; but the scents, within certain limits, may be varied at will:—Take of plain pomade, 1½ pounds avoirdupois; oil of lemon, 1½ Imperial fluid drachms; oil of lavender (English), balsam of Peru, and essence royale, of each 1 fluid drachm; oil of cassia, oil of cloves, and essence de petit-grain, of each ½ fluid drachm. Or, plain pomade, 1 pound, and essence or extrait de millefleurs, 4 to 5 fluid drachms.

1269. Peruvian Pomade. Take ½ ounce each good washed lard, and clarified beef suit; balsam of Peru, ¼ ounce; mix as before, add ½ fluid drachm oil of nutmeg, and pour it into pots or dumpy, wide-mouthed phials. Dr. Copland adds a little oil of lavender. In high repute as a hair-restorer.

1270. Philocome. This compound is made without heat. Equal parts of purified beef-marrow, oils of noisettes and sweet almonds are thoroughly mixed in a marble mortar, and the whole is then perfumed by the addition of a sufficient quantity of a mixture of extracts of rose, acacia, jasmin, orange-flower and tuberose.

1271. Vanilla Pomatum. Take of plain pomade 1 pound avoirdupois; melt and add 4 or 5 Imperial fluid drachms finest essence of vanilla; attar of roses, 8 or 10 drops, as before. Very fine. The plain pomade may be previously slightly tinged with annotto.

1272. East India Pomatum; Pomade des Indes; or Pomade d'Orient. Take beef-suet, ¾ pound avoirdupois; lard, ½ pound; pure bright beeswax, 2 ounces; finest annotto, 1 drachm; gum-benzoin in coarse powder, ¾ ounce; and grain-musk, 6 to 8 grains; digest in a covered vessel set in a water-bath, with frequent agitation, for 2 or 3 hours. After repose, decant the clear portion, add of oil of lemon, 1 Imperial fluid drachm; oil of lavender (English), ½ fluid drachm; oils of cassia, cloves and verbena, each 10 or 12 drops; and stir the mass until it has somewhat cooled. Lastly, pour it into pots or bottles, and let it cool very slowly, and undisturbed. Very fragrant.

1273. Transparent Pomade. Take of best transparent soap, 1½ drachms; 95 per cent. alcohol, 2½ ounces. Dissolve the soap in the alcohol by heat, and add it suddenly to a quart of hot castor oil; have perfume ready to put in at once, and pour in warm bottles. Another very superior article is prepared in the following way: Fatty oil of almonds, 2½ pounds; spermaceti, ½ pound; oil of lemon, 3 ounces. The spermaceti is melted in a water-bath, the oils are then added, and the heat kept up until a uniform mass is obtained, in which no floating particles of spermaceti can be distinguished. The pomade is then poured into glasses; if it is desired to obtain this pomade crystallized, the glasses must be heated beforehand, and cooled down very slowly.

1274. **Crystallized Pomade or Pomatum.** Take of oil of almonds or olives, 1 pint; ¼ pound spermaceti (best, pure); melt them together by a gentle heat, add scent at will, and whilst sufficiently warm to be clear, pour it into warm glass bottles, and allow it to cool very slowly, and without disturbance. Some persons add 1 drachm camphor. It is usually preferred uncolored. If tinged at all, it must be only very faintly so, and with substances that will not cause opacity.

1275. **Pomade Divine.** Take of refined beef-marrow, 1 pound avoirdupois; cypress-wood (rasped). orris root (in coarse powder), liquid styrax, of each 1 ounce; cinnamon (powdered, but not dusty), ½ ounce; cloves (well bruised), nutmegs (grated), of each ¼ ounce; digest, by the heat of a water-bath, in a covered vessel, for 5 or 6 hours, and then strain through flannel. Very fine, and much esteemed for the hair, and also as an occasional skin-cosmetic.

1276. **Castor Oil Pomade; Palma-Christi Pomatum.** Take of castor oil, 1 pound avoirdupois; pure white wax, 4 ounces; melt them together, and then add of oil of bergamot, 2½ drachms; oil of lavender (English), ½ drachm; essence royale, 10 or 12 drops; stir the mixture whilst cooling.

1277. **Bear's Grease.** The fat of the bear has long been highly esteemed for promoting the growth of human hair, but without sufficient reason, since experience shows that it possesses no superiority over the fats ordinarily employed by the perfumers. Indeed, if we may regard the somewhat rank smell of genuine bear's grease as an indication of its quality, it must be inferior to them as a hair cosmetic; besides which, it is much more costly. The greater portion of the so-called bear's grease now sold is a factitious article, and is prepared by the following formula:—

1278. **Imitation Bear's Grease.** Take of washed hog's lard (dry), 1¼ pounds avoirdupois; melt it by the heat of a water-bath, add of balsam of Peru, 2 drachms; flowers of benzoin and palm oil (bright), of each 1 drachm; stir vigorously for a few minutes, to promote solution. Then remove the pan from the bath, and, after repose for a short time, pour off the clear portion from the sediment, and stir the liquid mass until it begins to cool.

1279. **Pomade for Incipient Baldness.** Melt over a water-bath, 12 ounces pure veal grease, 5 ounces nerval balsam, 5 ounces nutmeg butter, and 6½ ounces oil of almonds; triturate in a mortar until thoroughly mixed; then add 10 drops croton oil, and incorporate. Next dissolve 3½ ounces subcarbonate of soda in 1 ounce each of alcohol and distilled water; incorporate this with the pomade and perfume to taste.

1280. **Cazenave's Pomade.** Prepared beef-marrow, 4 ounces (avoirdupois); tincture of cantharides, ½ fluid ounce (Imperial); and cinnamon, coarsely powdered, ½ ounce; melt them together by the heat of a water-bath; stir until the spirit in the tincture has evaporated, decant the clear portion, and again stir until the mass concretes. It is cheaper and more convenient to omit the powdered cinnamon, and to strongly scent it with oil of cinnamon (or of cassia), after the removal of the vessel from the bath. Some scent it with the oils of origanum and bergamot; and others employ the oils of nutmeg and lavender for the purpose. Recommended in weak hair and remediable baldness. It is ordered to be used night and morning; the head being washed with soap and water, and afterwards with salt and water, and wiped dry, each time before applying it, or at least once a day.

1281. **Tar Pomade.** Dr. Dauvergne extolled in unmeasured terms the virtue of vegetable tar in failing hair and baldness. His formula is as follows:—6¼ troy ounces lard; 5 drachms Norwegian tar; 3½ drachms each butter of nutmegs and gum-benzoin; 5 drachms fiovarenti balm; 5 drachms baume de commander; 1 ounce essence of patchouli; and 3 grains musk; mix. This formula appears unnecessarily and absurdly complicated. We have no hesitation in stating that the substitution of 3 to 5 drachms English oil of lavender, and 2 drachms essence of musk or essence royale, for the last four articles, would disguise the smell of the tar quite as well, without impairing the efficacy of the preparation.

1282. **Dupuytren's Pomade.** Take 12 avoirdupois ounces prepared beef-marrow; melt by a gentle heat, add baume nerval, 4 ounces; 3 ounces each balsam of Peru and oil of almonds; and mix thoroughly. Then add alcoholic extract of cantharides, 36 grains, dissolved in 3 Imperial fluid drachms rectified spirit; stir the mass until it concretes. This is the original formula for this celebrated pomade; but, in serious cases, Dupuytren was in the habit of doubling, or even tripling the proportion of the extract of cantharides without altering that of the other ingredients. The product is a genial stimulant and rubefacient, and, not undeservedly, has long been held in high esteem as a hair-cosmetic, acting by medicating the scalp.

1283. **Soubeiran's Pomade.** Take of oil of almonds, ½ ounce; disulphate of quinine, 1 drachm; triturate them together in a warm wedgwood ware mortar until thoroughly united; then add of prepared beef-marrow, 1½ ounces; and continue the trituration until the mass is cold. Scent may be added. Recommended for strengthening and restoring the hair.

1284. **Pomade Contre l'Alopécie, to Cure Baldness.** Fresh lemon juice, 1 drachm; extract of bark (by cold water), 2 drachms; marrow, 2 ounces; tincture of cantharides, 1 drachm; oil of lemon, 20 drops; oil of bergamot, 10 drops; mix. First wash the head with soap and water, with a little eau de Cologne, then rub it dry. Next morning rub in a small lump of pomade, and repeat it daily. In 4 or 5 weeks the cure of baldness is effected.

1285. **New French Remedy for Baldness.** Croton oil, one of the last French remedies for baldness, is employed by simply adding it to oil or pomade, and stirring or agitating the two together until admixture or solution be complete. The formula adopted by the eminent French physician who introduced this remedy, and who speaks, in the most confident and enthusiastic way, of the success attending its use, is—take of croton oil, 12 drops (minims); oil of almonds, 4 Troy drachms; mix. A little is to be well rubbed on the scalp twice a day. Soft down, we are assured, appears in three weeks. Mr. Cooley says: "I have tried a number of experiments with croton oil, thus used, in partial loss of hair and baldness, and am compelled to bear testimony to its efficacy in several apparently hopeless cases, in which even cantharidine had failed. Soft hair, resembling down, did begin to appear in from 3 to 4 weeks, and continued to grow and increase in strength for some time. It was, however, only in about one-third of these cases that this down subsequently increased in stiffness and quantity so as to well cover the part, and to deserve the name of hair, in the popular sense of the word." (*See No.* 1286.)

1286. Caution about Strong Hair Cosmetics. Although the stronger hair cosmetics are, as a rule, perfectly safe when applied according to the directions given, and the chief inconvenience that may arise, even from their too free or injudicious use, will be only temporary irritation, perhaps accompanied or followed by slight desquamation of the cuticle, or by a few unimportant pustules which will pass off in two or three days, yet there are cases in which their application would be unwise, and liable to produce more serious consequences. Thus, persons of a nervous temperament, with a highly irritable skin, and bad habit of body, persons liable to attacks of erysipelas, or to swollen glands behind the ears, or to swellings or tumors in the upper part of the neck behind, or to eruptive or other attacks of the scalp, and the like, should not have recourse to them. In other cases, and, indeed, in all cases, it is wise to use them very sparingly, or in a diluted state at first, and thus, as it were, feel our way, and be able to judge from experience the strength that can be employed, without inconvenience, to produce the desired effect. (*See Nos.* 1177, *&c.*, 1279, *&c.*, *and* 1285.)

1287. Hungarian Pomade for the Moustache. Melt by a gentle heat ½ pound gum-arabic, and ½ pound of oil soap, in 1 pint rose water, then add 1 pound white wax, constantly stirring; when of a uniform consistency, add 1 ounce attar of bergamot, and ½ drachm attar of thyme, for perfume. If required to be brown, color it with tube-burnt amber; or for black, use tube ivory-black.

Tooth Powders; Dentifrices; Poudres pour les Dents; &c.

These preparations should be compounded of materials which, while cleaning the teeth without injury to the enamel, will also be anti-acid, anti-scorbutic, and tonic in their action upon the gums. Cooley says: "Great care should be taken to finely pulverize all the dry ingredients, and to reduce the harder and gritty ones to the state of impalpable powder, either by patient levigation or trituration, or by elutriation. (*See Nos.* 25, 31, *and* 14.) To ensure the perfect mixture of the ingredients, they should be stirred together until they form an apparently homogeneous powder, which should then be passed or rubbed through a fine gauze-sieve. Those which contain volatile or perishable substances, or which, like charcoal, are affected by contact with the air, should be put up in dumpy, wide-mouthed bottles, and kept closely corked." "Tooth powders are nearly all compound powders. The only simple powder in common use as a dentifrice is powdered charcoal. Powdered bicarbonate of soda, cream of tartar, &c., are also employed, though less frequently." The following list includes some of the best tooth-powders in common use, as well as several advertised nostrums and named powders of the stores. By omitting the honey and spirit, the formulæ given for tooth pastes furnish others for tooth powders; and vice versâ. Thus, the example given under each will increase the number of the other; and both will suggest to the reader other formulæ.

1289. Poudre Détersive Dentifrice. Willow charcoal and white sugar in impalpable powder, each 8 ounces; calasaya bark in impalpable powder, 4 ounces; mix thoroughly in a mortar, sift through the finest bolting cloth, and perfume with a mixture of attar of mint, 2 drachms; attar of cinnamon, 1 ounce; and tincture of amber, ½ ounce.

1290. Camphorated Chalk. Precipitated carbonate of lime (chalk), 1 pound; powdered orris root, 3½ pounds; powdered camphor, ¼ pound; reduce the camphor to fine powder by triturating it in a mortar with a little alcohol; then add the other ingredients, and when the mixture is complete, sift through the finest bolting cloth. (*See No.* 28.)

1291. Precipitated Chalk. This is prepared by adding a solution of carbonate of soda to a solution of chloride of calcium (both cold), as long as a precipitate forms. This last is well washed with pure water, and dried out of the dust, as the last. The refuse sulphate of lime of the soda-water makers, which is poisonous in quantity, is often sold for it by the druggists. Pure chalk is wholly soluble in vinegar, and in dilute acetic, hydrochloric, and nitric acid, with effervescence. Sulphate of lime is insoluble in these fluids.

1292. To make Prepared Chalk. Rub 1 pound chalk with sufficient water, added gradually, to make it a smooth cream; then stir this into a large quantity of water, after the coarser particles have settled decant the milky fluid into another vessel, and allow the chalk to settle; decant the clear water, and dry the sediment.

1293. To Purify Hartshorn. Burn pieces of harts' horns until perfectly white; then grind them, and purify in the same manner as chalk. (*See No.* 1292.)

1294. Lardner's Tooth Powder. Take of powdered charcoal (recent), 1 ounce; prepared chalk (*see No.* 1292), 3 ounces; mix, and keep it from the air. A simple, but good tooth powder, known also as *Lardner's Prepared Charcoal.*

1295. Miahle's Rational Dentifrice. Take of sugar of milk, 3 ounces; tannin (tannic acid), 3 drachms; red lake, 1 drachm; oil of mint and oil of aniseed, of each 7 or 8 drops; neroli, 4 or 5 drops; mix. Very serviceable in foul, lax, or bleeding gums, loose or rotten teeth, &c. As a tooth powder it is improved by the addition of 1 ounce each of burnt hartshorn and cuttle-fish bone.

1296. Deschamp's Dentifrice for Removing the Yellow Color from Teeth. Take of dry hypochlorite of lime, ½ drachm; red coral, 2 drachms; triturate well and mix thoroughly. This powder is employed in the following manner: a new brush is slightly moistened, then dipped in the powder and applied to the teeth. According to Deschamp, a few days' use of this powder will produce a marked alteration in the appearance of the the teeth, which will acquire a white color.

1297. An Excellent Dentifrice. Precipitated chalk (*see No.* 1291), 1 pound; powdered borax, ½ pound; powdered myrrh, 4 ounces; powdered orris, 4 ounces. Mix, and sift through finest bolting cloth. (*See No.* 28.)

1298. Morfit's Dentifrice. Powdered willow charcoal, 4 ounces; chinchona bark and sugar of milk, in powders, each 1 pound; old transparent soap, in powder, 4 ounces; mix in a marble mortar, sift through the finest bolting cloth (*see No.* 28), and perfume with attar of orange-flower, 1 ounce.

1299. Grosvenor's Tooth Powder. Take of red coral, 6 ounces; prepared oyster-shells, 5 ounces; orris root, 1 ounce; oil of rhodium, 4 or 5 drops; mix. This is the original formula. Equal parts of prepared shells, rose-pink, and cuttle-fish bone, are now generally substituted for the coral. It is also sold as *coral dentifrice* and *coral tooth powder*. They are all favorites in the fashionable world.

1300. Violet Tooth Powder. Take of precipitated chalk, 6 ounces; cuttle-fish bone, 3 ounces; rose-pink (bright), 2½ ounces; orris root, 1½ ounces; essence of violets (orris), ½ fluid drachm; indigo (pure, to strike a violet tint), a sufficient quantity; mix. A favorite dentifrice among ladies.

1301. Areca Nut Tooth Powder. Take of areca nut charcoal, 5 ounces; cuttle-fish bone, 2 ounces; areca nuts (raw), 1 ounce; mix. About ½ drachm each of cloves and cassia are usually added, but it is better without any such addition. Areca nut charcoal, in fine powder, is often sold under this name. This powder cannot be excelled. (*See No.* 1302.)

1302. Areca Nut Charcoal is prepared and kept by only a few houses; four-fifths of that sold by the druggists is spurious. The genuine powder is heavier and harder than common charcoal, and has a peculiar appearance and feel, when pressed with the fingers, which is readily distinguishable.

1303. Pearl Dentifrice; Pearl Tooth Powder. Take of white marble-dust, 4 ounces; cuttle-fish bone, 1 ounce; smalts (finest), 1 drachm; essence de petit-grain, 10 to 12 drops; mix. A favorite with ladies who have white, healthy teeth. Precipitated chalk or heavy carbonate of magnesia is commonly substituted for the marble-dust, but the quality of the product suffers in all but color.

1304. Pelletier's Quinine Dentifrice. Take of red coral, 3 ounces; myrrh, 1 drachm; disulphate of quinine, 15 grains; scent at will; mix. Recommended as a tonic for the teeth and gums. Prepared oyster-shell is commonly substituted for the coral, and a little red bole added to color it.

Tooth Pastes; Tooth Electuaries; Pates pour les Dents.

These may consist of any of the substances ordinarily used as dentifrices, reduced to the state of inpalpable powder, and beaten up with sufficient honey (liquefied by a gentle heat), syrup, or capillaire, to give them the form of a smooth and moderately stiff paste or electuary, a sufficient quantity of aromatics being usually added, as it were, to "embalm and perfume the mouth." Honey of roses is often, and conserve of roses sometimes, used for those in which their odor and color are suitable. A little rectified spirit is a useful addition, as tending to preserve them, and promote their action. A little eau de Cologne or lavender water is often employed, with the same intention. They are usually put up in porcelain or ornamental glazed earthenware pots, furnished with closely fitting covers, to preserve their contents from the air. The mixed powders should be passed through a very fine gauze-sieve, before adding the honey, and the paste should not be potted until the day following that on which it is made. (*See No.* 1288.)

1306. Ward's Tooth Paste. Take of prepared chalk (*see No.* 1292), 2 ounces: myrrh, rhatany root, and cuttle-fish bone, each, ½ ounce; orris root, ¼ ounce; honey, 3 ounces. A very useful dentifrice in foul, spongy, and scorbutic gums, loose and rotten teeth, &c. This is also known as *Zeiter's Anti-scorbutic Dentifrice.*

1307. Areca Nut Charcoal Tooth Paste. Areca nut charcoal (recent, in fine powder), beaten up with pure honey or capillaire. Aromatics, though commonly added, do not improve its efficacy. (*See No.* 1302.)

1308. Areca Nut Tooth Paste. Take of recently burnt areca-nut charcoal, in fine powder (*see No.* 1302), 5 parts; raw or unburnt areca nuts, 1 part; honey, liquefied by a gentle heat, and allowed to cool, sufficient to make them into a stiff paste, adding gradually, for each ounce of the mixture, about 1 fluid drachm rectified spirit, holding in solution oil of cassia and oil of cloves, of each 10 or 12 drops. The next day beat up the mass again, adding, if necessary, a few drops of proof spirit, or of eau de rose or orange-flower water, to give it a proper consistence, and at once put it into pots. A very excellent preparation.

1309. Vanilla Tooth Paste. Take of the finest vanilla, 1 drachm; cloves, ½ drachm; lump sugar and cuttle-fish bone, of each ½ ounce; white marble-dust, 1 ounce; mix, triturate them to an inpalpable powder, and then beat them to a paste with about 2 ounces syrup of saffron. The product is much esteemed for rapidly whitening the teeth and deodorizing the breath. 5 or 6 drops of essence of ambergris or musk, dissolved in 1 fluid drachm of rectified spirit, are often added, and improve it.

1310. Peruvian Bark Tooth Paste. This paste is made by adding 1½ or 2 drachms of Peruvian bark, in very fine powder, to the last receipt. It is a useful tonic in sponginess, foulness, and scurvy of the gums. (*See No.* 1318.)

1311. Soap Tooth Paste. Take of Castile soap (air-dried, in fine powder), and cuttle-fish bone, of each 2 ounces; honey, 4 or 5 ounces; aromatics or perfume at will, with or without the addition of a little rectified spirit. A very excellent preparation, superior to all the other pastes for cleaning the teeth and removing tartar and animalculæ from them, but inferior in blanching and preservative qualities to areca nut charcoal paste. A pink or rose color may be given it by adding 1 drachm of finely powdered cochineal, or a fluid drachm or two of the tincture. It is commonly ordered in books to be made with honey of roses, but the alkali of the soap spoils the color of this article. The above preparation is also known under the names of *Spanish Dentifrice,* and *Castilian Tooth Cream.*

1312. Violet Tooth Paste. Take of prepared chalk, 3 ounces; cuttle-fish bone and white sugar (powdered), of each, 2 ounces; orris root (powdered), 1 ounce; smalts, 2 to 3 drachms; mix with sufficient syrup of violets to make a paste. A fashionable tooth-paste, highly esteemed for its power of cleaning the teeth, and its delicate color and odor.

1313. Odontine. There are several dentifrices advertised under this name, two or three of which have acquired a very large sale in the fashionable world. That of an eminent perfumery house appears to have the following composition:—Cuttle-fish bone, Castile soap and red coral, equal parts; color with tincture of cochineal and mix with honey sufficient to make a paste, and essential oils to aromatize, a sufficient quantity of each.

1314. Pellitier's Odontine is said to consist of pulverized sepia-bone (cuttle-fish bone), with a little butter of cacao, beaten up with honey and aromatized or scented with essential oils.

1315. Magic Tooth Paste. Take of white marble-dust, 2 ounces; pumice-stone in impalpable powder, 1½ ounces; rose-pink, ½ ounce; attar of roses, 7 or 8 drops; mix as before with sufficient honey to make a paste. A favorite nostrum for rapidly cleaning and whitening the teeth, but one not adapted for free or frequent use.

1316. Charcoal Tooth Paste. Take of chlorate of potassa in very fine powder, 1 drachm; finely powdered charcoal, 2 ounces; honey (best raw, cold), 1½ ounces; sufficient mint water to flavor; form a paste as before. A rather unchemical mixture, esteemed, particularly by smokers, for deodorising the teeth and breath.

1317. To Prepare Charcoal as a Dentifrice. To prepare charcoal of the highest quality, as a dentifrice, requires considerable skill and care. The substance, whether wood or nut, should not be in larger than one inch pieces; the carbonization should be effected in covered crucibles, at a low red heat—in no case exceeding a dull cherry red,—and the whole should be cooled out of contact with the air. On opening the crucible, only those pieces should be selected for use which are properly burnt, and have a uniform dark color and a dull surface. If the heat employed be much higher than that named, the charcoal acquires a brilliant surface, and is greatly deteriorated in quality. The pieces selected should be kept in close vessels for further use or operation; any exposure to the air weakens its power of absorption.

1318. Peruvian Tooth Paste. This is formed by adding about 1½ to 2 drachms of Peruvian bark, in very fine powder, to every ounce of the dry ingredients of any simple tooth paste, before beating them up with honey or syrup. A useful tonic for tender, spongy, foul, or scorbutic gums, and said to fix loose teeth. A little powdered myrrh is sometimes added.

1319. Quinine Tooth Paste. Take red coral, 3 ounces; cuttle-fish bone, 1 ounce; disulphate of quinine, ½ drachm; mix, triturate to very fine powder, add honey (white), 4 ounces; and a few drops attar of roses, or neroli, dissolved in rectified spirit, 3 fluid drachms; and beat the whole to a paste. A little powdered myrrh (1 to 3 drachms) is sometimes added. A very fashionable and popular article. Use, &c., the same as Peruvian paste.

1320. Opiate Tooth Paste. Honey, powdered orris, and precipitated chalk (*see No.* 1291), each ½ pound; rose pink, 2 drachms. Rub into paste with simple syrup, and perfume with oils of cloves, nutmeg, and rose, each ½ ounce.

1321. Patey's Orris Tooth Paste. Take 1 pound Paris white, ½ pound rose pink, 3 ounces orris root; alum, ½ ounce; oil cloves and nutmegs, each 1 drachm. Use honey enough to form a paste.

1322. Dr. King's Tooth Paste. Prepared chalk (*see No.* 1292), 1 part; powdered Peruvian bark, 1 part; powdered old Windsor soap, 1 part. Mix with equal parts of the tinctures of rhatany and myrrh; oil of checkerberry to flavor. This paste is a fine preparation for soft, spongy gums and loose teeth.

Tooth and Mouth Washes.

These are used to rinse the mouth, and particularly the teeth and gums, a few drops, more or less, of them being added to about a wine-glassful of water for the purpose. In some cases their action is promoted by the use of the tooth-brush.

1324. Eau Botot. Tincture of cedar wood, 1 pint; tincture of myrrh and rhatany, each 4 ounces; oil of peppermint and rose, each 10 drops. Mix.

1325. Violet Mouth Wash. Tincture of orris, essence of rose, and alcohol, each ½ pint; oil of almonds, 5 drops. Mix.

1326. Mexican Tooth Wash. Take of pulverized orris root, 1 ounce; tonqua beans, 1 ounce; Peruvian bark, ½ ounce; oak bark, ½ ounce; alcohol, 1 pint; water, 1 pint; let the above stand for 12 days, and filter; color with alkanet root. An elegant tooth wash.

1327. Balm of Thousand Flowers. Take of white Castile soap, 2 ounces; honey, 4 ounces; water, 12 ounces; alcohol, 4 ounces; melt the Castile soap and honey in the alcohol and water with a gentle heat. Flavor with oil of rose and wintergreen. Used as a dentifrice.

1328. Wash to Harden the Gums. Take ½ pint of Jamaica spirits, ½ tea-spoonful each powdered alum and saltpetre pulverized, and 1 ounce of pulverized myrrh. Mix.

1329. Cologne Tooth Wash. Eau de Cologne, 1 quart; tincture of myrrh, 4 ounces. Mix.

1330. Sozodont. Take of salts of tartar (carbonate of potassa), ½ ounce; honey, 4 ounces; alcohol, 2 ounces; water, 10 ounces; oil wintergreen and oil rose, sufficient to flavor. An elegant dentifrice.

1331. Cleveland's Tooth Wash. Tinctures of myrrh, Peruvian bark, and gentian root, each 1 fluid ounce; aqua ammonia, 1 drachm; pure water, ½ pint; tincture of wintergreen, or any flavor to suit; mix. This is a fine wash for the mouth, gums, and teeth.

1332. Myrrh Tooth Wash; Kirkland's Tooth Lotion. Take of tincture of myrrh, 1 ounce; water, 2 ounces; mucilage, ½ ounce; agitate them well together, and again each time before use. As a wash in rotten and loose teeth, foul, spongy, and ulcerated gums, fetid breath, &c., it is often very serviceable where there is a scorbutic taint.

1333. Myrrh and Borax Mouth Wash. Rub well together in a mortar, 1 ounce each of borax and honey; then gradually add 1 quart spirit of wine (not above proof), and add 1 ounce each of gum myrrh and red saunders wood. Macerate for 14 days, and filter. This is an excellent wash for the gums and mouth.

1334. To Cleanse the Spaces Between the Teeth. Some dentists recommend silk floss for cleaning the spaces between teeth, but we know from experience, that No. 8 gum rings are superior. They are much more convenient in every respect.

1335. Wash to Beautify the Teeth. Dissolve 2 ounces borax in 3 pounds boiling water, and before it is cold add 1 tea-spoonful spirits of camphor, and bottle for use. A table-spoonful of this mixture, mixed with an equal quantity of tepid water, and applied daily with a soft brush, preserves and beautifies the teeth, extirpates all tartarous adhesion, arrests decay, induces a healthy action in the gums, and makes the teeth pearly white.

1336. Cachou Aromatise. These popular pastilles for perfuming the breath are thus made: Dissolve 3½ ounces extract of liquorice in 4 ounces water, by the heat of a water bath, and add pulverized gum-arabic, ½ ounce; and Bengal catechu in powder, 1 ounce. Evaporate to the consistence of an extract, and then mix in thoroughly, powdered mastic, charcoal, cascarilla, and orris root, each ½ drachm. When the mass has been reduced to the proper consistence, it is to be removed from the fire, treated with attar of peppermint, 30 drops; tinctures of ambergris and musk, 5 drops; and then poured out upon an oiled slab, and rolled to a very thin sheet. After cooling, blotting paper is pressed upon it to absorb any adhering oil, and the surfaces are moistened with water, and covered with silver leaf. When dry it is to be divided into small bits of the size of a lentil.

Fumigating Pastils; Incense Pastilles. These are small masses essentially composed of powdered charcoal and aromatic substances that emit fragrant fumes during combustion, with the addition of sufficient nitre or saltpetre to cause them to slowly consume away, without flame, when kindled. Their common form is that of a small cone with a triangular or tripod base, of about ⅞ to 1 inch in height, and about ½ inch diameter at the larger part. This form is most simply and conveniently given them by pressing the mass, whilst soft, into a mould of lead or porcelain. The dry ingredients should be first reduced to fine powder, and the balsams and essential oils (if any) being added, the whole should be thoroughly and perfectly incorporated, after which the mixture should be beaten to the consistence of a stiff ductile mass or dough with the liquid ordered for the purpose. When powdered gum is one of the ingredients, the mass should be beaten up with water; but otherwise mucilage must be employed. Gum-tragacanth, owing to its greater thickening and binding powers, is here generally preferred to gum-arabic. The charcoal of the light woods, as the linden, willow, and alder, make the best pastils; that of the first being most esteemed for this purpose in France. The following receipts are among the best that can be made, and will serve as examples of these articles, from which the operator will be able to devise others:

1338. Dr. Paris's Fumigating Pastils. Pulverize ¼ pound benzoin, ¼ pound cascarilla, 1¼ ounces myrrh, and 1½ pounds charcoal; mix them through a sieve; then add ¾ ounce each of attars of nutmegs and of cloves; dissolve 2 ounces of nitre in sufficient mucilage of tragacanth to make the whole into a stiff paste; beat well in a mortar, make into pastils, and dry.

1339. Perfumers' Fumigating Pastils. Take of gum benzoin, 2 ounces (avoirdupois); olibanum (in tears), 1½ ounces; storax (in tears), 1 ounce; cascarilla and gum-tragacanth, of each ¾ ounce; nitre, 2 ounces; charcoal, 1¼ pounds; mix, and beat them up with water or rose water.

1340. Piesse's Fumigating Pastils. Dissolve ¾ ounce nitre in ½ pint rose water; mix this with ½ pound willow charcoal, and dry it thoroughly in a warm place. When the nitrated charcoal is perfectly dry, pour upon it a mixture of ½ drachm each of the attars of thyme, caraway, rose, lavender, cloves, and santal; then stir in 6 ounces benzoic acid (flowers of benzoin); mix thoroughly through a sieve, then beat in a mortar with sufficient mucilage to bind together. Make into pastils, and dry.

1341. Basis for French Pastils. Take of charcoal, 1½ pounds avoirdupois; nitre, 2 ounces; gum-tragacanth, 1 ounce; mix in the dry state. It is used as a basis for the following French pastils, as well as many others:—

1342. Pastilles aux Fleurs d'Oranges. To each pound of Nos. 1341 or 1339, add of orange powder (genuine), 2½ ounces avoirdupois; neroli, 1 Imperial fluid drachm; and beat up the mass with eau de fleurs d'oranges.

1343. Pastilles à la Rose. To each pound of Nos. 1341 or 1342, add of pale rose powder, 3 ounces avoirdupois; essence of roses, 2 Imperial fluid drachms; and beat up the mass with eau de rose.

1344. Pastilles à la Vanille. To each pound of Nos. 1339 or 1341 (usually the first), add of vanilla (in fine powder), 2 ounces avoirdupois; cloves (in fine powder), ½ ounce; essence of vanilla, ½ Imperial fluid ounce; oil of cloves, oil of cassia, of each ½ fluid drachm; and beat up the mass with cinnamon water.

1345. Pastils of Every Variety. The products of the preceding formulæ are of excellent quality. They may be varied, to please the fancy of the maker, by the omission of some of their aromatic ingredients, or by the addition or substitution of others. Cheaper articles are made by simply increasing the proportion of the charcoal and saltpetre. Good burning qualities depend greatly on the completeness of the mixture, and the moderate compactness of the mass. If they burn too slowly, a little more saltpetre may be added; if too fast, the quantity of saltpetre should be slightly lessened. Musk and civet, though often ordered in books as ingredients in pastils, should be avoided, as they give out a disagreeable odor during combustion. Ambergris is also unsuited for an ingredient in them.

1346. Incense. Storax, 2½ ounces; benzoin, 12 ounces; musk 15 grains; burnt sugar, ½ ounce; frankincense, 2½ ounces; gum-tragacanth, 1½ ounces; rose-water sufficient to form a mass; to be divided into small tablets.

1347. Incense. Powdered cascarilla, 2 ounces; myrrh, storax, benzoin, burgundy pitch, each 1 ounce; mix. Or:

1348. Fine Incense. Take of olibanum (true), 7 parts; gum benzoin, 2 parts; mix. Or: To the last, add of cascarilla 1 part. The preceding, placed on a hot iron plate, or burned in a censer, were formerly used to perfume apartments. The incense used in the rites of the Roman Catholic Church, and in the temples of India, consists wholly or chiefly of olibanum.

1349. Preserved Flowers and Herbs. Flowers, herbs, and other like vegetable substances, are now generally preserved, for distillation, by means of common salt. The process simply consists in intimately mixing the flowers, &c., with about ¼ their weight of good dry salt, and ramming down the mixture as tightly as possible, in strong casks or jars. The casks or jars are then placed in the cellar, or other cold place, and covered with boards, on which heavy weights are put, to keep the mass tight and close. In this state they may be preserved from season to season, or even for two or three years. The flowers, &c., should be recently gathered, and free from dew or moisture; and the salt should be quite dry, to ensure which it may be exposed for 2 or 3 hours in an oven. The above is the method now generally followed, by our manufacturing perfumers and wholesale druggists, for preserving fresh aromatic vegetable substances for subsequent distillation. It is found that the odor of distilled waters, oils, &c., obtained from flowers, &c., thus preserved, is superior to that of those from either the recent or dried vegetables; whilst the products keep better, and are quite free from the peculiar rawness found in those from fresh herbs and flowers, and which nothing but age, or redistillation, will remove.

1350. To Scent Tobacco. Fragrance may be imparted to tobacco, by mixing with it, while slightly damp, a little cascarilla, either in very fine shreds or recently powdered; or by a like addition of any of the substances noticed under fumigating pastils (*see No.* 1339) of which the odor is appropriate to the purpose. Cigars may be perfumed by moistening them externally with concentrated tincture of cascarilla, or tincture of benzoin or storax, or a mixture of them; or a minute portion of the powders, shred roots, or woods, may be done up with the bundle of leaves that form the centre of the cigar. The so-called anti-choleraic and disinfecting cigars are scented with camphor, cascarilla, and benzoin.

1351. Scented or Aromatic Candles. These are prepared by introducing a very small quantity of any appropriate aromatic into the material (fat, wax, or wick) of which they are made, whilst it is in the liquid state. Camphor, gum benzoin, balsam of Peru, cascarilla, essential oils, &c., are generally the substances selected. Care must be taken not to overdo it, as then the candles will burn smoky and give little light.

1352. To Make Snuff Scents. Of the substances used, singly and combined, to scent snuff, the following may be mentioned as the principal:—tonqua beans, and their oil or essence; ambergris, musk, civet, and their essences.

1353. To Scent Snuff. A sufficient quantity of the powder, essence, or oil, having been well mixed with a little snuff, the perfumed mixture is added to the whole quantity of snuff to be scented, and the mass well stirred up and turned over. It is lastly passed or rubbed through a sieve, to ensure the perfect diffusion of the scent through the whole mass.

1354. To Restore the Odor of Musk. Genuine musk frequently becomes nearly inodorous by keeping, but its perfume is restored by exposing it to the fumes of ammonia, or by moistening it with ammonia water.

1355. Peau d'Espagne, or Spanish Skin, is merely highly-perfumed leather. Take of oil of rose, neroli, and santal, each ½ ounce; oil of lavender, verbena, bergamot, each ¼ ounce; oil of cloves and cinnamon, each 2 drachms; in this dissolve 2 ounces gum benzoin. In this steep good pieces of waste leather for a day or two, and dry it over a line. Prepare a paste by rubbing in a mortar, 1 drachm of civet with 1 drachm of grain musk, and enough gum-tragacanth mucilage to give a proper consistence. The leather is cut up into pieces about 4 inches square; two of these are pasted together with the above paste, placed between 2 pieces of paper, weighted or pressed until dry. It may then be inclosed in silk or satin. It gives off its odor for years; is much used for perfuming paper, envelopes, &c.; for which purpose 1 or 2 pieces of the perfumed leather, kept in the drawer or desk containing the paper, will impart to it a fine and durable perfume.

Syrups. Syrups are solutions of sugar more or less strong according to the object for which they are used. In the preparation of syrups, if care be taken to employ the best refined sugar, and either distilled water or filtered rain water, they will be rendered much less liable to spontaneous decomposition, and will be perfectly transparent, without the trouble of clarification.

1357. Clarification of Sugar for Syrups. When inferior sugar is employed, clarification is always necessary. This is best done by dissolving the sugar in the water or fruit juices cold, and then beating up a little of the cold syrup with some white of egg, and 1 or 2 ounces of cold water, until the mixture froths well; this must be added to the syrup in the boiler, and the whole whisked up to a good froth; heat should now be applied, and the scum which forms removed from time to time with a clean skimmer. As soon as the syrup begins to slightly simmer it must be removed from the fire, and allowed to stand until it has cooled a little, when it should be again skimmed, if necessary, and then passed through a clean flannel. When vegetable infusions or solutions enter into the composition of syrups, they should be rendered perfectly transparent, by filtration or clarification, before being added to the sugar.

1358. Filters for Syrups. Syrups are usually filtered, on the large scale, by passing them through creased bag filters; on the small scale, conical flannel bags are usually adopted. Thick syrups filter with difficulty, hence it is a good plan to dilute them before filtering, and afterwards evaporate them to the required consistency. For small quantities clarification involves less trouble than filtration. (*See No.* 1357.)

1359. To make a Conical Filter. Take a square piece of flannel or Canton flannel, fold it diagonally, and sew two of the corresponding edges together with an over-lap seam, leaving the other two edges open; then fold the open edge over, sufficiently to make the opening level. (*See Fig.* 1.) This fold gives a considerable degree of stiffness to the open end, preventing the filter in some measure from collapsing. Professor Parrish, in his book on Practical Pharmacy, recommends the use of a conical wire frame (*see Fig.* 2) to support the filter. The frame is made to fit into the top of a suitable tin bucket, being supported by a rim or flange around the top of the frame, projecting sufficiently to rest on the edge of the bucket. The filter must fit the frame.

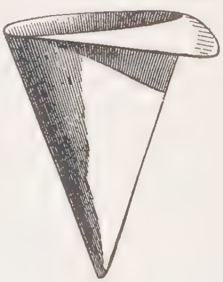


Fig. 1.

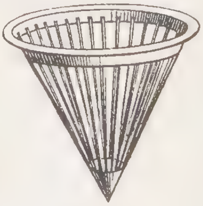


Fig. 2.

1360. Quantity of Sugar Used in Making Syrups. The proper quantity of sugar for syrups will, in general, be found to be 2 pounds avoirdupois to every pint of water or thin aqueous fluid. These proportions allow for the water that is lost by evaporation during the process, and are those best calculated to produce a syrup of the proper consistence, and possessing good keeping qualities. They closely correspond to those recommended by Guibourt for the production of a perfect syrup, which, he says, consists of 30 parts sugar to 16 parts water. To make highly transparent syrups the sugar should be in a single lump, and by preference taken from the bottom or broad end of the loaf; as, when taken from the smaller end, or if it be powdered or bruised, the syrup will be more or less cloudy.

1361. Amount of Heat to be Employed in Making Syrups. In the preparation of syrups it is of great importance to employ as little heat as possible, as a solution of sugar, even when kept at the temperature of boiling water, undergoes slow decomposition. The best plan is to pour the water (cold) over the sugar, and to allow the two to lie together for a few hours, in a covered vessel, occasionally stirring, and then to apply a gentle heat, preferably that of steam or a water-bath, to finish the solution. Some persons (falsely) deem a syrup ill prepared unless it has been allowed to boil well; but if this method be adopted, the ebullition should be only of the gentlest kind (simmering), and should be checked after the lapse of one or two minutes. When it is necessary to thicken a syrup by boiling, a few fragments of glass should be introduced, in order to lower the boiling point. In boiling syrups, if they appear likely to boil over, a little oil, or rubbing the edge of the pan with soap, will prevent it. Syrups are judged by the manufacturer to be sufficiently boiled, when some taken up in a spoon pours out like oil; or, a drop cooled on the thumb nail gives a proper thread when touched. (*See No.* 1368.) When a thin skin appears on blowing upon the syrup, it is judged to be completely saturated. These rude tests often lead to errors, which might be easily prevented by employing the proper proportions, or determining the specific gravity.

1362. Table of Specific Gravities of Syrups.

The degrees of Baumé here given are those of his heavy saccharometer.

Sugar in 100 parts.	Specific Gravity.	Degrees Baumé.
0	1.000	0°
5	1.020	3
10	1.040	6
15	1.062	8
20	1.081	11
25	1.104	13.5
30	1.128	16.3
35	1.152	19
40	1.177	21.6
45	1.204	24.5
50	1.230	27
55	1.257	29.5
60	1.284	32
67	1.321	35

The latter density is about the syrupus of the pharmacopœias; that of the U. S. Ph. has a sp. grav. 1.317; that of the British Ph. is 1.330.

1363. To Determine the Density of Syrup. A fluid ounce of saturated syrup weighs 577½ grains; a gallon weighs 13⅕ pounds avoirdupois; its specific gravity is 1.319 to 1.321, or 35° Baumé; its boiling point is 221° Fah., and its density at the temperature of 212° is 1.260 to 1.261, or 30° Baumé. The syrups prepared with the juices of fruits mark about 2° or 3° more on Baumé's scale than the other syrups. (*Cooley.*) According to Ure, the decimal part of the number denoting the specific gravity of a syrup, multiplied by 26, gives the number of pounds of sugar it contains per gallon, very nearly.

1364. To Preserve Syrups. The preservation of syrups, as well as of all saccharine solutions, is best promoted by keeping them in a moderately cool, but not a very cold place. Let syrups be kept in vessels well closed, and in a situation where the temperature never rises above 55° Fah. They are better kept in small than in large bottles, as the longer a bottle lasts, the more frequently it will be opened, and, consequently, the more it will be exposed to the air. By bottling syrups whilst boiling hot, and immediately corking down and tying the bottles over with bladder, perfectly air-tight, they may be preserved, even at a summer heat, for years, without fermenting or losing their transparency.

1365. To Prevent Syrup from Candying. The candying or crystallization of syrup, unless it be over-saturated with sugar, may be prevented by the addition of a little acetic or citric acid (2 or 3 drachms per gallon); confectioners add a little cream of tartar to the sugar, to prevent granulation.

1366. To Prevent Syrup from Fermenting. The fermentation of syrups may be effectually prevented by the addition of a little sulphite of potassa or of lime. A celebrated French chemist recommends the addition of about 3 to 4 per cent. sugar of milk, with the same intention. Fermenting syrups may be immediately restored by exposing the vessel containing them to the temperature of boiling water. The addition of a little spirit is also good.

1367. To Bleach Syrup. Syrups may be decolored by agitation with, or filtration through, animal charcoal.

1368. Degrees of Boiling Sugar. In preparing sugar for candies, &c., the confectioner requires different degrees of boiling in order to bring the sugar to the proper state for the various articles he prepares. Well clarified and perfectly transparent syrup is boiled until a skimmer dipped into it, and a portion touched between the forefinger and thumb, on opening them, is drawn into a small thread which crystallizes and breaks. This is called a *weak candy height.*

If boiled again, it will draw into a larger string, and if bladders may be blown with the mouth through the drippings from the ladle, it has acquired the second degree, and is called *bloom sugar.*

After still further boiling, it arrives at the state called *feathered sugar.* To determine this, dip the skimmer and shake it over the pan, then give it a sudden flirt or jerk, and the sugar will fly off like feathers.

The next degree is that of *crackled sugar,* in which state the sugar that hangs to a stick dipped into it, and put directly into cold water, is not dissolved off, but turns hard and snaps.

The last stage of boiling reduces it to *caramel sugar,* and is proved by dipping a stick into the sugar and then into cold water, when, on the moment it touches the water, it will snap like glass. It has now arrived at a *full candy height.*

Throughout the boiling, the fire must not be too fierce, as it will discolor the syrup. The best safeguard against this is the use of steam heat. Color may be given to the candy by adding the coloring matter to the syrup before boiling it. Flavoring essences must be added when the process is nearly complete.

1369. To Make Syrups for the Manufacture of Cordials and Liquors. Take 1 pint of water to every 2 pounds of sugar used; this proportion will make a fine syrup, about 32° Baumé, but the manufacturer often requires weaker syrups when preparing inferior cordials, and the easiest method of ascertaining the proper point of concentration is by the use of that variety of Baumé's hydrometer, called a saccharometer. Beat up the whites of 2 eggs (if you are clarifying about 10 pounds of sugar, or mix in this proportion), until it is very frothy, and then mix in with the rest.

1370. Plain Syrup. Put into a very clean copper, 100 pounds loaf sugar and 3 gallons water; take the white of 12 good eggs, whisk them up to a froth in a pan, and put them into a copper before the fire is lighted; stir them well in the sugar, make a good fire, and let the mixture be still. As it comes toward boiling, the scum will rise; be particular not to let it bubble or boil, but simmer; as soon as the scum is seen to break through the edge of the copper, damp the fire, and take off the first scum; then stir it up and let it simmer; keep skimming it until it becomes clear and bright, and the scum as white as milk; then draw your fire, and take it out of the copper, and it will be fit for use. The quantity thus made will be 10 gallons.

1371. Gum Syrup. Dissolve 20 pounds best clear white gum-arabic in 4 gallons water nearly boiling hot; take 60 pounds sugar, melt and clarify it with 1 gallon water, add the gum solution, and boil for 2 minutes.

1372. Raspberry Syrup. This syrup is sometimes used to give a vinous body and flavor to brandy. It is made of 2 pints filtered raspberry juice, and 4¼ pounds sugar. Select the fruit, either white or red. Having picked them over, mash them in a pan, which put in a warm place until fermentation has commenced. Let it stand for about 3 days. All mucilaginous fruits require this, or else they would jelly when bottled. Now filter the juice through a close flannel bag, or blotting-paper, and add sugar in the proportion mentioned above; this had better be powdered. Place the syrup on the fire, and as it heats skim it carefully, but do not let it boil; or mix it in a glass vessel or earthenware jar, and place in a pan of water on the fire. (This is simply a water-bath.) When the syrup is dissolved, so that when you dip your fore-finger in it and apply it to the ball of your thumb, and then separate the thumb and finger, the fine thread of syrup reaches from each without breaking, take it off; strain through a cloth; bottle when cold; cover with tissue paper dipped in brandy, and tie down with a bladder until wanted for use.

1373. Imitation Raspberry Syrup. Dissolve 50 pounds white sugar in 10 gallons water; then make an infusion of ½ pound powdered orris root in ½ gallon boiling water, in a covered vessel, stirring occasionally as it cools, and when cold, filter through flannel; stir this infusion into the syrup; then stir in ½ pound tartaric acid previously dissolved in 1 quart water. Color the mixture with ¼ to ½ gallon cherry juice, using more or less, as required to produce the desired color. This produces a splendid imitation of raspberry syrup at a comparatively trifling cost.

1374. Parrish's Strawberry Syrup. Take 4 quarts fresh fruit; express the juice, and strain; add water until it measures 4 pints. Dissolve 8 pounds raw sugar in this by the aid of heat; raise it to the boiling point, and strain. If it is to be kept till the following season, it should be poured, while hot, into dry bottles, filled to the neck, and securely corked. This furnishes a key for the treatment of the whole family of fruit juices.

1375. Lemon Syrup. Take 5 gallons lemon juice, 1 ounce best oil of lemons dissolved in ½ pint of alcohol; or the rinds of 16 lemons rubbed with sugar to extract the essential oil; dissolve 80 pounds of sugar in the juice, and boil for 2 minutes; skim, then strain.

1376. Orgeat Syrup. Take 10 pounds sweet almonds, 4 pounds bitter almonds; cover them with boiling hot water; let them stand till nearly cold, and peel them by pressing through your fingers; beat them in a stone or brass mortar to a very fine paste with some sugar, adding water slowly; press through a linen cloth, so as to get 5 gallons of a liquid resembling rich milk; dissolve in this liquid 80 pounds sugar; boil up once, and add 1 pint orange-flower water; then strain.

1377. Arrack Punch Syrup. Take 53⅛ pounds sugar; 3⅓ gallons water. Boil up well, then add 1⅔ gallons lemon juice, and stir till the liquid is clear; pour it into a clean tub, and, when nearly cool, add 5 gallons Batavia arrack, then filter.

1378. Syrup of Coffee. Take 10 pounds best Java coffee, fresh roasted and ground, and 6 gallons boiling water. Let it stand, well covered, till cool; strain and press; next dissolve in this infusion 80 pounds sugar; boil and skim for 2 minutes, and then strain.

1379. Cinnamon Syrup. Take 1 ounce oil of Ceylon cinnamon, rubbed and dried up with carbonate of magnesia in a mortar, so as to make it a powder; put it in a filter bag, and pour 5 gallons water on it; pour the water over and over till it runs clear; get in this way 5 gallons clear high-flavored water; dissolve 80 pounds of sugar in the flavored water, and boil for 2 minutes; then skim and strain.

1380. Sirop Capillaire. Maidenhair Syrup. Take 1 pound maidenhair herb, and 5½ gallons boiling water. Macerate till cold; strain without pressing, so as to get 5 gallons; take the whites of 3 eggs beaten to froth, and mix them with the infusion; keep back a quart of the liquid; then dissolve and boil in the above 80 pounds sugar by a good heat; when the scum rises, put in a little from the quart of cold liquid, and this will make the scum settle; let it raise and settle 3 times; then skim, and when perfectly clear add ½ pint orange-flower water; then boil once up again and strain.

1381. Cherry Syrup. Take 5 gallons cherry juice; let it ferment a few days; dissolve and boil 80 pounds of sugar; when clear, skim and strain.

1382. Syrup of Orange Peel. Reduce 2 ounces dried orange peel to coarse powder, put it in a small glass percolator, and pour deodorized alcohol slowly on it till 6 fluid ounces of tincture have passed; evaporate this spontaneously to 2 fluid ounces; triturate this with ½ ounce carbonate of magnesia, 1 ounce sugar and ½ a pint water gradually added; pour this on a filter, and when it ceases to pass, add water till a pint of filtrate is obtained; to this add 2½ pounds sugar; dissolve with a gentle heat, and strain if necessary.

1383. Punch Syrup. Digest 8 ounces fresh lemon peel cut in small pieces and bruised, in 12 ounces Jamaica rum for 3 days, and strain. Mix 28 ounces strained lemon juice with 18 ounces rum; allow it to settle, and filter through paper. Dissolve 5 pounds powdered white sugar in 42 ounces rum at a gentle heat, and when cool, mix all the liquids together. This is in no way inferior to the most celebrated European punch syrups.

Syrups for Soda or Mineral Waters.

The following is a collection of well approved receipts for flavoring mineral waters, selected principally from the "Druggist's Circular and Chemical Gazette." Most of the syrups not made from fruits may have a little gum-arabic added, in order to produce a rich froth when the soda water is added.

1385. Simple Syrup. To 8 pounds finest white sugar, add 2 quarts water and the whites of 2 eggs; stir until all the sugar is dissolved; simmer for 2 or 3 minutes; skim well, and strain through a fine flannel bag. The following syrups for soda water may be produced by employing the above syrup as a basis. A variety of other syrups may be made in the same way by using the artificial fruit essences. (*See No.* 1045, *also last receipt.*)

1386. Simple Syrup. White sugar, 10 pounds; water, 1 gallon; isinglass (best), ¼ ounce (or, the white of an egg). Dissolve the isinglass in hot water, and add it to the hot syrup. The syrup is to be made with gentle heat, and then strained.

1387. Lemon Syrup. Add to simple syrup, when cold, 20 drops fresh oil of lemon and ½ ounce citric acid (previously dissolved in 3 ounces water) to each gallon. Mix by shaking well in a bottle, then add 4 ounces gum solution, made by dissolving 2 ounces fine white gum-arabic in 2 ounces warm water.

1388. Lemon Syrup. Grate off the yellow rind of lemons, and beat it up with a sufficient quantity of granulated sugar. Express the lemon juice, add 1 pint water to each pint of juice and 3½ pounds granulated sugar, including that rubbed up with the rind; warm until the sugar is dissolved, and strain.

1389. Sarsaparilla Syrup. To 1 gallon simple syrup add 10 drops oil of anise, 20 drops oil of wintergreen, 20 drops oil of sassafras, and 6 ounces caramel, or coloring. Before the oils are added to the syrup, they should be cut by grinding them in a mortar, with as much sugar as they will moisten, or mixed with a small quantity of strong alcohol.

1390. Sarsaparilla Syrup. Take oil of wintergreen, 10 drops; oil of anise, 10 drops; oil of sassafras, 10 drops; fluid extract of sarsaparilla, 2 ounces; simple syrup, 5 pints; powdered extract of liquorice, ½ ounce; mix well.

1391. Parrish's Syrup of Sarsaparilla for Mineral Waters. Take simple syrup, 4 pints; compound syrup of sarsaparilla, 4 fluid ounces; caramel, 1½ ounces; oil of wintergreen, 6 drops; oil of sassafras, 6 drops; mix.

1392. Ginger Syrup. Bruised Jamaica ginger, 2 ounces; boiling water, 1 pint; macerate for 4 hours; add fine white sugar, 2 pounds, and strain through a fine flannel bag. Ginger syrup may also be made by adding 2 ounces extract of ginger to 1 gallon simple syrup.

1393. Ginger Syrup. Tincture of ginger, 2 fluid ounces; simple syrup, 4 pints; mix.

1394. Vanilla Syrup. Vanilla, 6 drachms; boiling water, 4½ pints; sugar, 4 pounds avoirdupois. Reduce the vanilla to fine powder by trituration with a portion of the sugar; boil this with water for 2 hours in a covered vessel, then strain.

1395. Vanilla Syrup. Fluid extract of vanilla, 1 ounce; citric acid, ½ ounce; simple syrup, 1 gallon; rub the acid with some of the syrup, add the extract of vanilla, and mix.

1396. Wild Cherry Syrup. Steep 4 ounces wild cherry bark, well bruised, in 1 pint cold water, for 36 hours; press out the infusion; let it stand till clear; decant, and add 1½ pounds fine white sugar; mix and strain.

1397. Wild Cherry Syrup. Moisten 5 ounces wild cherry bark, in coarse powder, with water, and let it stand for 24 hours in a close vessel. Then pack it firmly in a percolator, and pour water upon it until 1 pint of fluid is obtained. To this add 28 ounces sugar.

1398. Strawberry Syrup. Take fresh strawberries and inclose them in a coarse bag; press out the juice, and to each quart add 1 pint water and 6 pounds white sugar; dissolve by raising it to the boiling point, and strain; bottle and cork hot, and keep in a cool place.

1399. Strawberry Syrup. Take fresh strawberries, 5 quarts; white sugar, 12 pounds; water, 1 pint. Sprinkle some of the sugar over the fruit in layers, and allow the whole to stand for several hours; express the juice and strain, washing out the pulp with water; add the remainder of sugar and water, bring the fluid to the point of boiling, and then strain. This will keep for a long time.

1400. Strawberry Syrup. Strawberry juice, 1 pint; simple syrup, 3 pints; solution of citric acid (*see Fruit Acid*), 2 drachms; mix.

1401. Fruit Acid (used in some of the syrups). Citric acid, 4 ounces; water, 8 ounces.

1402. Strawberry Syrup Without the Fruit. Add to 1 gallon simple syrup, 2 tea-spoonfuls essence of strawberry, and ¼ ounce tartaric acid. Color with coloring made as follows: Boil 1 ounce cochineal with ½ tea-spoonful of cream of tartar. Strain.

1403. Raspberry Syrup. Make as directed for strawberry syrup, either with the fruit or the essence. The flavor of this syrup is improved by using 1 pint currants to 5 of raspberries.

1404. Blackberry Syrup. Make as directed for strawberry, and add to each quart 1 ounce of the best French brandy.

1405. Pineapple Syrup. Take a convenient number of pineapples, pare and mash them in a marble or porcelain mortar, with a small quantity of sugar; express the juice, and for each quart take 1½ pints water and 6 pounds fine sugar; boil the sugar and water, then add the juice; remove from the fire, and skim and strain. Or make it with the essence, as directed for strawberry. (*See No.* 1402.)

1406. Pineapple Syrup. Oil of pineapple, 1 drachm; tartaric acid, 1 drachm; simple syrup, 6 pints; mix. Or: Take 1 gallon expressed pineapple juice; sugar, 15 pounds; fruit acid (*see No.* 1401), 2 ounces; mix.

1407. Wintergreen Syrup. Oil of wintergreen, 25 drops; simple syrup, 5 pints; sufficient burnt sugar to color (*see No.* 694); mix.

1408. Maple Syrup. Take maple sugar, 4 pounds; water, 2 pints.

1409. Chocolate Syrup. Mix 8 ounces chocolate in 2 pints water, and stir thoroughly over a slow fire. Strain, and add 4 pounds white sugar.

1410. Orange Syrup. Take a convenient number of fresh and ripe oranges, grate off the outside yellow peel; cut the oranges and express the juice; and to each quart add 1 pint water and 6 pounds sugar, previously well mixed with the grated peel. Dissolve by gentle heat, then strain.

1411. Pear Syrup. Make as directed for pineapple syrup, or use the essence of pear, by adding to each gallon of simple syrup 2 tea-spoonfuls essence of pear and ¼ ounce of tartaric acid.

1412. Apple Syrup. Make as directed for pineapple syrup; or with the appropriate fruit essence and acid, as above.

1413. Banana Syrup. Make as directed for pineapple syrup; or with the appropriate fruit essence, as before directed. (*See No.* 1402.) Or: Take oil of banana, 2 drachms; tartaric acid, 1 drachm; simple syrup, 6 pints; mix.

1414. Grape Syrup. Brandy, ½ pint; spirits of lemon, ¼ ounce; tincture of red saunders, 2 ounces; simple syrup, 1 gallon. Mix.

1415. Orgeat Syrup. Take 3 ounces sweet almonds and ½ ounce bitter almonds; gum-arabic in powder, ½ ounce; sugar in powder, 3 ounces. Rub together in a mortar, adding water from time to time, until the mixture measures 1 quart. Strain through a cloth, and mix with 1 gallon of simple syrup.

1416. Imitation Orgeat Syrup. Cream syrup, 1 pint; vanilla syrup, 1 pint; oil of bitter almonds, 4 drops. Or: About 2 drachms imitation cream syrup (*see No.* 1430) are to be mixed with 2 ounces simple syrup and flavored with bitter almond and orange-flower waters.

1417. Orange-Flower Syrup. Add to 1 gallon simple syrup ½ ounce extract of orange flowers.

1418. Coffee Syrup. Coffee, roasted, ½ pound; boiling water, 1 gallon. Enough is filtered to make ½ gallon of the infusion, to which add granulated sugar, 7 pounds.

1419. Nectar Syrup. Strawberry syrup, ½ pint; Madeira wine, 1 ounce; orgeat syrup, ½ pint. Mix.

1420. Nectar Syrup. Vanilla syrup, 5 pints; pineapple syrup, 1 pint; strawberry, raspberry, or lemon syrup, 2 pints. Mix.

1421. Sherbet Syrup. Vanilla syrup, 3 pints; pineapple syrup, 1 pint; lemon syrup, 1 pint. Mix.

1422. Ambrosia Syrup. Raspberry syrup, 2 pints; vanilla syrup, 2 pints; Hock wine, 4 ounces. Mix.

1423. Hock and Claret Syrup. Hock or claret wine, 1 pint; simple syrup, 2 pints. Mix.

1424. Solferino Syrup. Brandy, 1 pint; simple syrup, 2 pints. Mix.

1425. Cream Syrups. These are prepared by mixing highly flavored syrups with fresh cream. As this latter does not keep well, it is a more economical plan to make a simple cream syrup in suitable quantities, and to add a portion of it to the flavored syrup as required. This prevents the loss of different flavored syrups by spoiling, and allows of the cream being used for any flavored syrup.

1426. Simple Cream Syrup. Mix together thoroughly 1 pound powdered sugar with 1 pint fresh cream. Keep it in pint bottles for use.

1427. Taylor's Cream Syrup. Fresh cream, ½ pint; fresh milk, ½ pint; powdered sugar, 1 pound. Mix by shaking, and keep in a cool place. The addition of a few grains of bicarbonate of soda will for some time retard souring.

1428. Hubbell's Cream Syrup. This is prepared with 1¾ pounds sugar to 1 pint of cream.

1429. Cream Syrup. Take of fresh cream, 1 pint; fresh milk, 1 pint; fine powdered sugar, 3 pounds; beat the sugar with the milk and the whites of 2 eggs, then mix with the cream. Flavor with vanilla, lemon, or strawberry. Keep in a cool place, well bottled.

1430. Imitation Cream Syrup. Make an emulsion with 3 fluid ounces fresh oil of sweet almonds, 2 ounces powdered gum-arabic, and 9 ounces water; then dissolve 1 pound white sugar by a gentle heat, strain, and when cool, add the whites of 2 eggs. It should be put up in small bottles, well corked, in a cool place. This is not only an excellent imitation and substitute for cream syrup, but will keep well for a considerable time.

1431. Cream Syrup. Take of fresh unskimmed milk, 1 pint; sugar, 2 pounds, Troy. Dissolve by shaking in a bottle, add ⅓ of this to ⅔ of any of the fruit syrups; or, for vanilla cream, add about a table-spoonful of fluid extract of vanilla to 1 pint.

1432. Vanilla Cream Syrup. Fluid extract of vanilla, 1 ounce; simple syrup, 3 pints; cream (or condensed milk), 1 pint. May be colored with carmine.

1433. Coffee Cream Syrup. Coffee syrup, 2 pints; Cream, 1 pint.

1434. Nectar Cream Syrup. This is a mixture of 3 parts vanilla syrup, 1 part pineapple syrup, 1 part lemon syrup, and 1 part simple cream syrup.

Alcohol. Alcohol is a light, transparent, colorless, volatile, inflammable fluid; mixes in all proportions with water, with evolution of heat and condensation of the mixture, but some hours elapse before the union is complete. It dissolves resins, essential oils (*see No.* 940), camphor, bitumen, soaps, sugar, the alkaloids, wax, spermaceti, and various other substances. Boils at 172°, and in a vacuum at 56° Fahr.; curdles milk; coagulates albumen, and separates both starch and gum from their mucilages; uncongealable by cold; powerfully antiseptic to animal or vegetable substances immersed in it; with acids it forms ethers. Its evaporation, like that of ether, produces intense cold. By undergoing the acetic fermentation it is converted into vinegar. Dilute alcohol may be procured by the ordinary process of distillation, from *all* fermented liquors; when drawn from wine, as in France, it is called brandy; when from rice, as in the East Indies, it is called arrack or *toddy;* when from grain or malt, as in the United States or Great Britain, it is called whiskey, and when from molasses or the juice of the sugar-cane, as in the West Indies, it is called rum.

Whiskey is the spirit from which alcohol is usually obtained in this country.

By distilling a hundred gallons of whiskey, between 50 and 60 gallons of alcohol are received in the condenser of a specific gravity of 0.835. By a second distillation, taking care to collect only the first portions, and cautiously managing the heat so as not to allow it to rise to the temperature of boiling water, alcohol may be obtained of a specific gravity of 0.825, which is the lightest spirit that can be received by ordinary distillation. At this stage it contains 11 per cent. of water and some small portions of fusel oil.

The best alcohol is that manufactured under Attwood's patent process, in which manganic acid is used to destroy the fusel oil and other foreign substances. This alcohol withstands the tests of nitrate of silver and sulphuric acid remarkably well. (*See No.* 1444.)

The high wine, or rectified spirit, distilled and rectified in the United States, and often sold as French pure spirit, is free from all deleterious substances, and nearly scentless. Its strength is usually from 84 to 95 per cent. (*See Nos.* 53, *&c.*)

1436. Proof Spirit contains 52½ per cent. by volume of pure alcohol; has a specific gravity of .920 at 60° Fahr.; and is no more than a mixture of 49 parts by weight pure alcohol with 51 parts water. This is the strength of the proof spirit usually employed by perfumers, and for medicinal purposes; but by law (*see No.* 58), proof spirit is equal parts by volume of absolute alcohol and distilled water, having a specific gravity of .933.

1437. Dilute Alcohol. Alcohol dilutum (*U. S. Ph.*) consists of equal measures of officinal alcohol and water; it contains 39 per cent. by weight, or 46.33 per cent. by volume, of pure or absolute alcohol, and has a specific gravity of .941, equal to 19° of Baumé's light hydrometer.

1438. Alcohol. Officinal alcohol (*U. S. Ph.*) contains 85 per cent. by weight, or 89 per cent. by volume, of pure alcohol; its specific gravity is .835, or 38.45° Baumé.

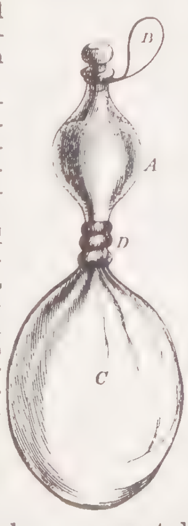
1439. Stronger Alcohol. Alcohol fortius (*U. S. Ph.*) has 92 per cent. by weight, or 94.65 per cent. by volume, of pure alcohol; and a specific gravity of .817, or about 42° Baumé.

1440. Amylic Alcohol. A peculiar oily, nearly colorless acrid liquid, known also as *Fusel oil*, obtained by distilling fermented grain or potatoes, by continuing the process after the ordinary spirit has ceased to come over. Its specific gravity is .818, and its boiling point 268° to 272° Fahr. (*U. S. Ph.*)

1441. Absolute Alcohol. To procure absolute or anhydrous alcohol, take the bladder of an ox or calf, soak it for some time in water, then inflate it and carefully free it from the attached fat and vessels; this must be done on both sides. After it is again inflated and dried, smear over the outer surface *twice*, and the inner surface *four* times, with a solution of isinglass. Then nearly fill it with the spirit to be concentrated, leaving only a small space vacant; it is then to be securely fastened, and suspended in a warm situation, at a temperature of about 122° Fahr., over a sand bath, or in the neighborhood of an oven or fire. In six to twelve hours, if the heat be properly conducted, the spirit will be concentrated, and in a little time longer may be rendered nearly free from water (anhydrous) or of the strength of 97 or 98 per cent.

This alcohol will be sufficiently pure for all the common purposes of the manufacturers, and is an excellent spirit for making varnishes, &c.

The same bladder will serve more than one hundred times; and in fact a *common* bladder, thoroughly cleansed from fat, and washed and dried, may be used without any further preparation. The bladder should be kept very nearly full, or else a portion of the spirit will escape through the empty part. To prevent this accident, a bottle with a double neck, of the shape represented in the engraving, may be employed. By this means the bladder may be kept always full.



A, A bottle with two necks, the upper furnished with a ground-glass stopper.

B, Loop of cord to hang up the apparatus.

C, Bladder containing spirit, filled by means of the bottle, *A*.

D, Neck of bladder accurately secured to the lower neck of the bottle, *A*.

After the first or second time of using the bladder, it gives alcohol sufficiently pure for most experimental purposes. Before hanging the apparatus up, it is better to enclose and suspend it in a coarse netting, which will prevent any accident arising from the strain on the neck of the bladder. Should weaker spirit than that directed in the preceding formula be used, to procure alcohol by either method, it must be previously concentrated, or the operation repeated a second time.

Absolute alcohol is used to dissolve resins by the varnish maker; essential oils, by the perfumer; pyroxyline (gum cotton), by the photographer; and by the pharmaceutist to prepare tinctures and for many other purposes.

1442. Chemical Method of Procuring Absolute Alcohol. Take 1 gallon of the alcohol of commerce; throw 1 pound freshly made chloride of calcium into the alcohol, and, as soon as it is dissolved, distill off 7 pints and 5 fluid ounces. Or, take of rectified spirit 1 imperial pint; lime, 18 ounces; break the lime into small fragments, mix with the alcohol in a retort properly connected, and expose the mixture to a gentle heat until the lime begins to slake; then withdraw the heat until the slaking is finished. Now raise the heat gently and distill off 17 fluid ounces. Alcohol thus obtained will have a density, when the operation is carefully managed, of 0.796.

1443. To Increase the Strength of Common Alcohol. Take a pint of common spirits, and put it into a bottle which it will only fill about ¾ full. Add to it ½ ounce pearlash or salt of tartar, powdered as much as it can be without occasioning any great loss of its heat. Shake the mixture frequently for about half an hour, before which time a considerable sediment, like phlegm, will be separated from the spirits, and will appear along with the undissolved pearlash or salt at the bottom of the bottle. Then pour the spirit off into another bottle, being careful to bring none of the sediment or salt along with it. For this purpose an instrument called a *separating funnel* is well adapted. To the quantity just poured off add ½ ounce pearlash, powdered and heated as before, and repeat the same treatment. Continue to do this as often as necessary, till little or no sediment forms; when this is the case, 1 ounce of alum, powdered and made hot, but not burned, must be put into the spirits, and suffered to remain some hours, the bottle being frequently shaken during the time; after which the spirit, when poured off, will be found free from all impurities, and equal to the best rectified spirits of wine.

1444. To Test the Purity of Alcohol. The presence of water may be detected by its specific gravity. Fusel oil may be detected by adding a little of a solution of nitrate of silver to the alcohol. Dissolve 10 grains nitrate of silver in 1 ounce of pure distilled water. Then take half a tumblerful of the suspected liquor and drop into it 25 drops of the above solution; and if the liquid should contain any grain oil, it will assume the form of a black powder and float on the surface. The action of this test is not always immediate, for it is sometimes necessary to wait from 1 to 30 hours when testing a sample of alcohol which has been well rectified, before any evidence of the oil or powder can be perceived floating on the liquid, and even then it is necessary to expose the glass to a strong light before the powder can be discovered.

For detecting fusel oil in alcohol, Mr. E. N. Kent finds pure sulphuric acid the best test. Half fill a test tube with the spirit to be tested, then fill up slowly with pure concentrated sulphuric acid. Pure spirit remains colorless; impure spirit becomes colored in proportion to the amount of fusel oil present. 1 per cent. of wood spirit (wood naphtha) in alcohol, will cause it to turn yellow or brown with the addition of caustic potassa. Pure alcohol is neutral to test paper; should be colorless; will evaporate entirely by heat; retains its transparency when combined with water or ether; tastes and smells vinous.

1445. **To Free Alcohol from Fusel Oil.** This may be effected by digesting the alcohol with charcoal. By Schaeffer's method the alcohol is filtered through alternate layers of sand, wood-charcoal, boiled wheat, and broken oyster shells; this removes all other impurities as well. The fusel oil can be extracted from small quantities of alcohol, by adding a few drops of olive oil to the spirit, agitating thoroughly in a bottle, and, after settling, decanting. The olive oil dissolves and retains the fusel oil.

1446. **To Deodorise Whiskey or Alcohol and free it from Fusel Oil.** To the barrel of liquor add about a gallon (or more) of water saturated with chlorine; stir up thoroughly, and let it rest for 12 hours. Then saturate with chalk; add another gallon of water, and distill.

1447. **To Filter Alcohol.** The following method of filtering alcohol, or its solutions, is said to be very satisfactory, and is used extensively in North Germany, where it constitutes one of the secrets of the trade. Clean, unsized paper (Swedish filtering paper is the best), is torn into shreds and stirred into the liquid to be clarified. The whole is then strained through a flannel bag, when the resulting liquid will be found to possess the utmost clearness and limpidity. A filter may also be made by spreading thin paper pulp evenly upon stretched flannel or woolen cloth. When dry, the cloth so coated will be found to give better results than the felts, etc., commonly employed as filters. (*See Nos.* 714 *and* 811.)

1448. **To Test the Strength of Alcohol.** Alcohol dissolves chloroform, so that when a mixture of alcohol and water is shaken up with chloroform, the alcohol and chloroform unite, leaving the water separate. On this fact Basile Rakowitsch, of the Imperial Russian Navy, has founded his invention. The instrument he uses is a graduated glass tube into which a measured quantity of chloroform is poured, and to this is added a given quantity of the liquid to be tested; these are well mixed together and then left to subside; the chloroform takes up the alcohol and leaves the water, which, being lighter than the chloroform, will float on the top; and the quantity of water that has been mixed with the spirit will be at once seen.

1449. **Arithmetical Rules for the Treatment of Alcohol.** The following excellent rules, derived from various sources, contain, and will yield to the manufacturer, much information of a very useful character.

1450. **To Ascertain the Cost of any Quantity of Alcohol at any Degree or Percentage of Strength Above or Below Proof.** Alcohol is always bought and sold at so much above or below proof. To ascertain the price of a quantity of alcohol, add the percentage over proof, or deduct the percentage under proof, and multiply by the price per gallon. Thus: what will 40 gallons of alcohol, 25 per cent. over proof, cost at 28 cents proof? We first find 25 per cent. of 40, which is 10; we then add that number to 40, the number of gallons, and we get 50; we then multiply 50 by 28, the price per gallon proof, and get $14.00, or 35 cents per gallon. Again, what will 40 gallons alcohol, 25 per cent under proof, cost, at 28 cents per gallon proof? Again, we find that 25 per cent. of 40 is 10; we then deduct 10 from 40, this leaves us 30; by multiplying 30 by 28 we get $8.40, or 21 cents per gallon.

1451. **To Ascertain How Much Water Should be Added to Spirits, to Reduce it from a Given Degree of Strength to a Lower Degree or Percentage of Strength.** The manufacturer may sometimes find it necessary to reduce or increase the strength of spirit, according as circumstances may require. To accomplish this, we give the following rules, which will be found useful to the dealer: multiply the number of gallons by the actual degree of strength of the spirit, and divide the amount by the degree of strength sought to be obtained, and from the answer subtract 100; the amount thus obtained will show the quantity of water to be added to the spirit in order to reduce it to the degree sought. For example: suppose you have 100 gallons of spirit at 80° by Tralles' hydrometer, and wish to reduce it to 50° or proof. Multiply 100 by 80, and divide the amount by 50, then from the answer subtract 100; this will show that 60 gallons of water must be added to the spirit in order to reduce it to 50° Tralles', or proof.

Thus, 100 gallons
Multiplied by 80
———
Divided by 50)8000(160
Deduct 100
——
60

1452. **To Ascertain the Quantity of Pure or Absolute Alcohol in any Given Amount of Liquor.** The quantity of alcohol contained in any amount of liquor is readily ascertained after testing the strength with Tralles' hydrometer at 60° Fahr., by simply multiplying the figures expressing the quantity of liquor, by the ascertained strength; for example: a barrel of brandy containing 32 gallons, 60° strong at 60° Fah., contains 19¼ gallons pure alcohol. Rule.—Multiply the number of gallons by the ascertained degrees of strength, and divide by 100. Thus:

32 gallons,
60° Tralles' at 60° Fahr.
——
19.20, or $19\frac{1}{5}$ gallons pure alcohol.

1453. To Ascertain the Number of Gallons at any Required Number Below Proof, in any Given Number of Proof Gallons. Multiply the given number of proof gallons by 100, and then divide the product thus obtained by a number found by deducting the required number of degrees below proof from 100. The quotient will be the answer. For example: How many gallons, 25 below proof, are there in 35 gallons proof?

100 35 gallons proof,
25 B. P. 100
—— ——
75)3500($46\frac{2}{3}$ gallons 25 below proof.

We thus see by the above example that 35 gallons proof spirit is equal to $46\frac{2}{3}$ gallons 25 below proof.

1454. To Increase the Strength of a Spirit from any Degree to a Higher given Degree, or Percentage. To increase the degree of strength of a spirit, multiply the number of gallons by the actual degree of strength of the spirit, and divide by the degree of strength sought to be obtained. For example: suppose you have 100 gallons of spirit at proof, or 50° by Tralles' hydrometer, and wish to increase its strength to 80°. Multiply 100 gallons by 50 and divide by 80; the answer will give you the number of gallons of spirit, $62\frac{1}{2}$, to be added to the 100 gallons in spirit in order to increase its volume to 80° by Tralles' hydrometer.

Thus, 100
50
——
80)5000
——
62.4, or $62\frac{1}{2}$.

1455. To Reduce Spirit a Given Number Above Proof to a Required Number Below Proof, by the Addition of Water. Multiply the number of gallons of spirit by the sum of the given degree above proof and the required degree below proof, and divide the product by a number to be found by subtracting the required proof from 100. The quotient will give the number of gallons of water to be added.

Suppose you want to reduce 40 gallons spirit 20 above proof to 10 below proof, how much water must be added to accomplish the result?

100 40 gallons.
Required proof, 10 30
—— ——
90)1,200($13\frac{1}{3}$ gals. water.

It will thus be seen that, to reduce 40 gallons spirit 20 above proof to 10 below proof, it will be necessary to add $13\frac{1}{3}$ gallons of water, making $53\frac{1}{3}$ gallons in all.

1456. To Reduce High Proof Spirit to a Required Lower Proof, by the Addition of Water. First multiply the number of gallons by a number expressing the difference in degrees of strength between the given proof of the spirit to be reduced and the required degree, or proof, to which it is to be reduced. Divide the product thus ascertained by a number to be found by adding the required proof to 100.

Suppose you desire to reduce 72 gallons spirit at 30 above proof to 10 above proof, how much water must you add?

30, given strength.
10, required strength.
—
20, difference.
Required strength, 10 72, No. of gals.
100 20, difference.
—— ——
110)1,440($13\frac{1}{11}$ gals.

Thus it will be seen that, to reduce 72 gallons spirit at 30 above proof to 10 above proof, it is necessary to add $13\frac{1}{11}$ gallons of water, making about 85 gallons in all.

1457. To Reduce Spirit of a Given Number Above Proof to a Required Number Below Proof, by the Substitution of Water for Spirit. Deduct the number below proof from 100, and multiply the number of gallons by the remainder. Then add the number which the given liquor is above proof to 100, and divide the above product by the number thus obtained. The quotient, deducted from the original number of high proof gallons, will give the answer required. All small fractions may be rejected.

Suppose you want to reduce a cask of 40 gallons spirit at 20 above proof to 10 below proof.

100
10
——
Multiply 90
by 40
——
To 100 add 20=120)3,600(30
Original number of gallons, 40
Deduct quotient, 30
–
Answer, 10 gallons.

Thus it will be seen that 10 gallons should be removed, and their place supplied with water, in order to make the mixture equal to 10 degrees below proof.

1458. To Reduce Spirit of a Given Number Above Proof to Proof Spirit, by the Substitution of Water for Spirit. Multiply the number of gallons by 100, then add the number which the spirit is above proof to 100, and divide the above product by the number thus obtained; subtract the quotient from the number expressing the original quantity of spirit, and the answer will give the number of gallons to be removed from the spirit and replaced with water, in order to reduce the high proof spirit down to proof.

Suppose you want to reduce a cask of 24 gallons of spirit 20 above proof to proof spirit.

Above proof, 20 24
100 100
—— ——
120)2,400(20
Original quantity 24
20
—
Answer, 4

It will be seen by the above example that 4 gallons have to be taken from the spirit and the same quantity of water added, to reduce it to proof.

1459. To Raise Spirit of a Given Number Under Proof to a Required Strength Above Proof, by the Substitution of High Proof Spirit. Multiply the number of gallons by the number expressing the difference in degrees of strength between the high proof spirit to be added and the required degree to which it is to be raised. Divide the product thus found by a number to be obtained by adding the given number below proof to the number the high spirit is above proof; then subtract the quotient from the original number of gallons, and the remainder will show the quantity of low spirit to be removed and its place supplied by the addition of the same quantity of high proof spirit.

Suppose you desire to raise a cask of 40 gallons at 10 below proof to 15 above proof, by means of spirit 40 above proof:

40 40 A. P. 40 number of gals.
15 10 B. B. 25 multiplied by diff.
— — —
Diff. 25 50)1000(20
40 gals. original quantity to be raised.
20 deduct quotient.
—
20 answer.

The above example shows that 20 gallons should be taken from the low proof spirit, and the same quantity of spirit added at 40 above proof, to raise it to 15 above proof.

1460. To Raise Spirit of a Given Number Below Proof to Proof Spirit, by the Substitution of High Proof Spirit. Multiply the number of gallons by the number which the high proof spirit is above proof, divide the product by a number to be found by adding the given number the spirit is below proof to the number the high spirit is above proof; subtract the quotient from the original number of gallons, and the remainder will show the quantity of low proof spirit to be removed, and its place to be supplied by the addition of high proof spirit.

Suppose you desire to raise a cask of 40 gallons at 5 below proof, to proof, by means of spirit 35 degrees above proof.

35 A. P. 40 number of gallons.
5 B. P. 35 above proof.
— —
40)1400(35 quotient.
40 gallons,
35 quotient,
—
5 answer.

It will thus be seen that 5 gallons should be taken from the low proof spirit, and the same quantity of spirit added at 35 above proof, in order to raise it to proof strength.

1461. To Raise Spirit of a Given Number Above Proof to a Still Higher Degree of Strength, by the Addition of High Proof Spirit. First multiply the number of gallons by a number expressing the difference in degrees of strength between the given proof of the spirit to be raised, and the required degree to which it is to be raised. Divide the product thus ascertained, by a number to be found by subtracting the difference in degrees between the spirit to be raised and the high proof spirit employed to raise it. The quotient will show the number of gallons of a higher proof which must be added.

Suppose you desire to raise a cask of 35 gallons spirit 15 above proof to 20 above proof, by the addition of spirit 30 above proof.

20 required proof,
15 given proof,
—
5 difference.
From 30 35 number of gallons.
Subtract 15 5 multiplied by difference.
— —
15)175($11\frac{3}{5}$ answer.

1462. To Reduce Low Proof Spirit to a Still Lower Proof, by the Addition of Water. First multiply the number of gallons by the difference in degrees of strength between the given proof of the spirit to be reduced, and the required proof to which it is to be reduced. Divide the product by a number ascertained by subtracting the given proof from 100, and the quotient will give the number of gallons of water to be added.

Suppose you want to reduce 40 gallons spirit 10 below proof, to 15 below proof.

Required proof 15
Given proof 10
—
Difference 5
100 40 gallons
10 given proof 5 difference
— —
90)200($2\frac{2}{9}$ gals. water

1463. To Raise a Low Proof Spirit to a Higher Required Proof by the Addition of High Proof Spirit. Multiply the number of gallons by a number expressing the difference in degrees of strength between the given proof of the spirit to be raised, and the required proof to which it is to be raised. Divide the product thus ascertained by the sum of the given proof, and the high proof spirit to be added, and the quotient will give the answer.

Suppose you desire to raise 40 gallons spirit 15 below proof to 10 below proof with spirit 10 above proof.

Given proof 15
Required proof 10
—
Difference 5
Given proof 15 40 gallons
High proof 10 5 difference
— —
25)200(8 gals. answer.

Essential Oils; Volatile Oils.

The essential or volatile oils are an extensive and important class of bodies derived from the vegetable kingdom, and found in almost every part of the larger number of the plants which produce them, except the cotyledons of the seeds, which, in general, form the exclusive repository of the fixed oils. It is the volatile oils which confer upon flowers, leaves, fruit, seeds, roots, barks, and woods, their peculiar and characteristic odors; but among these they are not equally distributed in the same individual, and are often altogether absent from some of them. To them we are indebted for our most delightful perfumes, and our choicest aromatics and spices. All of them, when perfectly pure, are colorless; though, before rectification, nearly the whole of them have a pale yellow tint, and some of them are brown, blue, or green. They mix in all proportions with the fixed oils, dissolve freely in both alcohol and ether, and are sparingly soluble in water, forming perfumed or medicated waters. (*See Nos.* 1080, *&c.*) Their boiling point usually ranges between 310° and 325° Fahr., and is always considerably higher than water. They resist saponification and (excepting oil of cloves) do not combine with the salifiable bases. Their density fluctuates a little on either side of water. The lightest oil is that of citrons (specific gravity 0.847), and the heaviest, that of sassafras (specific gravity 1.096). When cooled sufficiently they all soldify. The common temperature of the atmosphere is sufficient for this with some of them, as the oils of roses and aniseed; whilst others require to be cooled below the freezing point of water before they assume the solid form. By exposure to the air they rapidly absorb oxygen, and become partially converted into resin. This is the cause of the deposit that usually forms in them (especially in the expressed oil of orange) when kept in an imperfectly stopped bottle. (*Cooley.*)

1465. To Obtain Essential Oils. All essential oils which are more or less volatile can be obtained from substances by distilling the articles along with an equal weight (some use a larger proportion) of water; but some substances that give out their oil with difficulty, are first soaked for 24 hours in twice their weight of water, to each gallon of which 1 pound of common salt has been added, by which its boiling point is raised, and consequently the oil comes over more easily. In such cases a quick fire is used, and when one half the water has come over, it is returned into the still, and this is repeated until the distilled water ceases to come over mixed with oil. The heat of steam or a salt water bath should be preferably employed; but if a naked fire be used, the still should be deep and narrow, by which means the bottom will be more perfectly covered when the quantity of water becomes small, and burning prevented. When the distilled water is to be repeatedly poured back on the ingredients, a very convenient plan is to so arrange the apparatus that, after the water has separated from the oil, it shall flow back again into the still, by which much time and trouble will be saved. The separation of the oil and water is effected by allowing the mixed liquids to drop into a Florentine receiver (*see Fig.* 1), when the oil is lighter than water, by which means the latter accumulates at *a*, and the water flows over by the spout, *b*. The essential oil is obtained in this manner from the following: Anise, caraway, wormseed, cubebs, fennel, pennyroyal, juniper, lavender, lemon, cinnamon, peppermint, spearmint, horsemint, origanum, pimento, rosemary, savine, sassafras, valerian, &c. The empyreumatic oil of tobacco is obtained by introducing the dry leaves in coarse powder into a green glass retort, heating it in a sand-bath to a dull red heat. Separate the oily liquid from the watery portion as it comes over, and keep for use. (*See No.* 46.) The same receiver may be employed for oils heavier than water, by reversing the arrangement; but a glass separator (*see Fig.* 2) will be found more convenient. In this case the oil accumulates at the bottom of the vessel, and may be drawn off by the cock. The oil of cloves and other heavy essential oils are obtained by macerating 5 pounds coarsely powdered material for 48 hours in 10 pounds water containing 1 pound salt; and distilling until the product is no longer milky. After the oil has deposited, the remaining water is again distilled, and this repeated until all the oil has been extracted from the water. After 10 days, the oil is cleaned and clarified by filtering. The essential oil of cloves, cinnamon, rhodium-wood, sandal, calamus, aloes, &c., are thus obtained. That of bitter almonds and of mustard are obtained by making a thin paste of the material with water; and, after 24 hours' maceration, distilling by steam-bath. The essential oils of lemons, oranges, and some other fruits, are chiefly obtained by submitting the yellow rind to powerful pressure; but in this way they are not so white, nor do they keep so well as when distilled. Volatile oils should be kept in well-closed and nearly full bottles, in the dark, and opened as seldom as possible, as by age and frequent exposure they become resinous. The process of distillation should be done as rapidly as possible, and the light oils collected soon after its separation from the water.

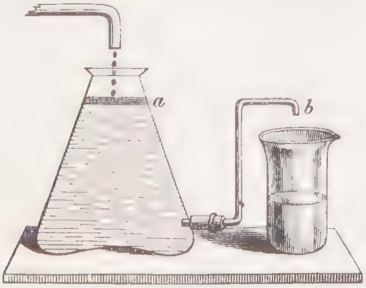


Fig. 1.

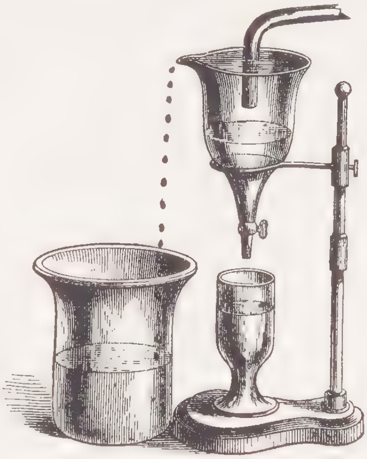


Fig. 2.

1466. Special Directions for Distilling Essential Oils. Substances yielding volatile oils are generally distilled with water, the proportion of which varies with each article, but under all circumstances must be sufficient to prevent the substance from burning before the whole of the oil has passed over. To prevent the risk of burning, it has been recommended to suspend the substance to be distilled in a basket, or a bag of wire-work, in the water, so as not to touch the bottom or sides of the alembic; or to place the substance on a perforated shelf in the upper part of the alembic above the surface of the water. Some substances, such as mustard, bitter almonds, &c., which are mixed to a paste with water, are distilled by the action of a current of steam heated to the necessary degree and admitted into the bottom of the alembic. An excess above what is necessary acts injuriously by holding some of the oil in solution after the mixed vapors are condensed; on the other hand, if too small a quantity be employed, besides the danger of burning, the whole of the oil will not be distilled. Dried plants require more water than the fresh and succulent.

The form of the alembic has an influence over the quantity of water distilled, which depends more upon the extent of surface than the amount of liquid; by employing a high and narrow vessel the disadvantage of an excess of water is much obviated.

The temperature should be equable, and regulated so as not to exceed the required degree of heat; and, as some oils are more volatile than others, an appropriate temperature must be obtained and sustained; the use of a higher temperature than is necessary being injurious. Any degree of heat can be steadily applied by the use of a bath, either of water or of some solution (weaker or stronger as required) of which the boiling point is known. (*See No.* 7.)

The more volatile oils pass freely with the steam into the neck of the receiver, but some that are less volatile are apt to condense in the head, and return into the body of the still; for these a still should be employed with a large and low head, having a rim or gutter inside, in which the oil may be received as it condenses, and thence led into the neck of the condensing tube (*see No.* 1077), which is better straight than coiled, for convenience in cleaning, as the alembic and all its appurtenances must be perfectly clean before distilling each kind of essential oil.

Certain flowers, such as orange flowers and roses, yield little or no oil when dry, and must be preserved fresh, either with salt, or by means of glycerine, to keep them in condition for distilling their oils. (*See No.* 1349.)

The most of the aromatic herbs are usually distilled while fresh, although it is thought by some that they yield a larger product when moderately dried. Dried substances require, previous to distillation, to be thoroughly macerated with water; and to facilitate this end, should be prepared by slicing, rasping, bruising, or other appropriate means. Sometimes the proportion of oil in the substance employed is so small that it is wholly dissolved in the water distilled, even though the smallest necessary quantity of water has been employed in the alembic. In this case the distilled solution must be redistilled several times with fresh quantities of the substance, until more oil passes over than the water will dissolve. This process is called *cohobation.*

1467. Millon's Method of Obtaining Essential Oils. The flowers are placed in a percolating apparatus (*see No.* 41) and then ether or sulphide of carbon is poured over them. After leaving the flowers in contact for 15 minutes the liquid is drawn off and a fresh supply added and drawn off in a similar manner. This completely dissolves all the essential oil of the flowers, leaving them quite scentless. The liquid is next distilled, and the ether or sulphide of carbon, being volatile at a much lower temperature than the fragrant principle, is drawn over alone, and leaves a residue containing all the perfume of the flower. This residue, more or less solid, is exposed to the heat of the sun until it loses the unpleasant smell of the solvent used. No degree of natural heat is capable of altering the perfume or turning it rancid. The product has a much finer odor than essential oil prepared by any other system.

1468. Cognac Oil. Oil of cognac is prepared by dissolving the fusel oil of brandy marc in strong rectified spirit, and then adding a sufficient quantity of concentrated sulphuric acid to form a sulphate; alcohol and excess of acid are removed by washing the newly formed compound with water. To 100 pounds marc add ½ pound sulphuric acid; the oil is generally formed towards the end of the distillation, and is found floating in blackish drops on the surface of the distillate. According to a distinguished French chemist, this oil is a compound of potato oil and œnanthic ether.

1469. Oil of Apple. Mix cautiously 1 part fusel oil, 3 parts sulphuric acid, and 2 parts water. Dissolve 2½ parts bichromate of potash in 4½ parts water, introduce this into a large tubulated retort, and gradually add the former liquid, so that the boiling continues very slowly. The distillate, which is principally valerianic acid, is saturated with carbonate of soda, and evaporated to dryness. Take of the valerianate of soda, thus formed, 1½ parts; fusel oil, 1 part; sulphuric acid, 1 part; mix cautiously, heat by a water-bath, and mix with water; the impure valerianate of amyloxide will separate. It is washed several times with water, then with a solution of carbonate of soda, and finally with water. This is dissolved in from 6 to 8 parts of water.

1470. Oil of Jargonelle Pear. This is made from the heavy fusel oil which comes over last in distillation. To purify the fusel oil, wash it with soda and water, and distill between 254° and 284° Fahr. Of this take 1 pound; glacial acetic acid, 1 pound; sulphuric acid, ½ pound. Digest for some hours at 254°. The ether separates upon the addition of water, and is purified by washing with soda and water. Mixed with $\frac{1}{30}$ part acetic ether, and 7 parts of deodorized alcohol, it gives the essence of pears.

1471. Oil of Quince—Pelargonic Ether—is made from oil of rue by treating it with double its volume of dilute nitric acid, heating the mixture until it begins to boil. After some time two layers are seen. The lower one is separated with a pipette, and freed from nitric acid by evaporation in a chloride of zinc bath; it is then filtered, mixed with deodorized alcohol, and digested at a gentle heat until the fruity odor is noticed. This ether seems identical with the ethereal oil of wine, which gives the bouquet. It is sometimes sold as oil of cognac.

1472. **To Restore the Fragrance of Oil of Lemon.** There are several oils that, by absorption of oxygen from the air, will become camphorated, grow turbid, deposit a residue, generally called stearopten, and lose more or less of their flavor, instead of which they acquire the odor of turpentine. Those oils that are free from oxygen are chiefly subject to these changes, and it is therefore necessary to keep them in full bottles, well stoppered, and in a cool place. When they have deteriorated in the way indicated, they may be improved, but can never be restored to their original quality. Many means have been proposed for this purpose, but the one now generally employed in France is to shake the oil with warm water several times, letting it settle, and drawing it off by means of a syphon; it may lastly be filtered either through paper or linen.

1473. **To Keep Oil of Lemon Fragrant.** To every pound of oil, 1 ounce alcohol is to be added and well mixed; then 1 ounce water is put with it, which again withdraws the alcohol from the oil, and collects at the bottom of the bottle as dilute alcohol, where it should be permitted to remain until the oil has been used, with, perhaps, an occasional shake-up when the bottle has been opened. Oil of lemon treated in this manner has been kept fresh and fragrant for over a year. *Oil of orange* may be treated in the same manner with excellent effect.

1474. **To Purify Essential Oils that have Deteriorated from Age.** The method most commonly pursued is by redistillation, mixing them first with water, and sometimes with alkali. There are, however, other processes that have been recommended, which are believed to be equally as efficacious, and at the same time more simple. M. Curieux proposes to submit them to the action of a solution of borax with animal black. The solution of borax is mixed with the animal charcoal to form a thin consistency; the oil is then added and agitated for a quarter of an hour. At the end of that time the borax mixture is found adhering to the sides of the bottle, while the oil flows limpid. The oil of lavender, neroli, and peppermint, M. Curieux had restored or purified in this manner. Mr. Charles Bullock, of Philadelphia, has found that permanganate of potash is admirably adapted to the purpose of the restoration of resinified essential oils. A large can of oil of lemon having become unsaleable, he agitated a solution of the potash with the oil for a length of time, then decanted, mixed with fresh water, and warmed gently, till the oil floated perfectly clear on the surface. The solution of the permanganate was in the proportion of 1 ounce of the salt to 8 ounces of water. This quantity was enough for 4 pounds of the oil.

1475. **To Detect the Presence of Fatty Oil and Resins in Essential Oils.** The presence of fatty oil, resin, or spermaceti, may be readily detected by placing a single drop of the suspected oil on a piece of white paper, and exposing it for a short time to heat. If the oil under examination be pure, it will entirely evaporate; but if it be adulterated with one of these substances, a greasy or translucent spot will be left on the paper. These substances also remain undissolved when the oil is agitated with three or four times its volume of strong rectified spirit.

1476. **To Detect the Presence of Alcohol in Essential Oils.** The presence of alcohol or rectified spirit may be detected by agitation with the oil a few small fragments of dried chloride of calcium. These will remain unaltered if the oil be pure, but will dissolve in one containing alcohol, and the resulting solution will form a distinct stratum at the bottom of the vessel. The milkiness and loss of volume, when such an oil is agitated with a little water, is another test of the presence of spirit. A more delicate test of the presence of alcohol in an essential oil than the preceding, is effected by potassium. Place 12 drops of the oil on a perfectly dry watch-glass, and put a piece of potassium, the size of an ordinary pin's head, in the middle of it. If the potassium remains unchanged for 12 or 15 minutes, no alcohol is present; bnt if it disappears after 5 minutes, the oil contains at least 4 per cent. of alcohol; if it disappears in less than 1 minute, it proves the presence of not less than 25 per cent. of alcohol. This species of adulteration is very common. It is a very general practice of the druggists to add strong rectified spirit to their essential oils, to render them transparent, especially in cold weather. Oil of cassia and oil of cinnamon are nearly always so treated by them.

1477. **To Detect the Admixture of one Essential Oil with Another.** The admixture of an inferior essential oil with another more costly, is readily detected by a connoisseur or expert, by placing a drop or two on a piece of clean blotting-paper, shaking it in the air, and smelling it occasionally. The difference of the odor at the beginning and towards the end of the evaporation will show the adulteration, especially if the adulterant be oil of turpentine. This last may also be detected by remaining undissolved when the oil is agitated with about thrice its volume of strong rectified spirit. Highly rectified oil of turpentine is very largely used to adulterate the stronger scented essential oils. Foreign oil of lavender and oil of peppermint, for example, are usually compounds of 1 ounce of the genuine oil with 9 ounces of oil of turpentine. Even American and English oil of peppermint are adulterated with ⅛ part rectified spirit, besides a considerable quantity of oil of spearmint, and often turpentine.

1478. **To Detect the Adulteration of a Heavy Oil with a Light One.** The adulteration of a heavy oil with a light one may be detected by agitating the suspected sample with water, when, in general, the two will separate and form distinct layers.

1479. **To Test the Purity of Essential Oil of Almonds.** Essential oil of almonds is very generally adulterated with cheaper oils, particularly nitrobenzole (artificial oil of bitter almonds), and in nearly every case with alcohol or rectified spirit. The pure oil, when mixed with *oil of vitriol*, turns of a clear crimson-red color, without visible decomposition:—mixed with *alcoholic solution of potassa*, crystals are eliminated:—*iodine* dissolves only partially and slowly in it, without further visible results:—*chromate of potassa* does not affect it:—*nitric acid* of the specific gravity 1.42 causes no immediate reaction, but crystals of benzoic acid begin to form in 3 or 4 days; if only 7 or 8 per cent. of alcohol be present, violent effervescence speedily commences, and colored nitrous fumes are evolved. Nitric acid of specific gravity 1.5 produces the same effects in a marked degree, even when the smallest quantity only of alcohol is present. The specific gravity of the pure oil, when recent, is never less than 1.052; and when old, never greater than 1.081; that of trade averages about 1.075. Nitrobenzole has the specific gravity 1.209, and its boiling point is 415° Fahr., or fully 100° higher than that of essential oil of almonds.

1480. To Test the Purity of Oil of Bergamot. Oil of bergamot is very frequently adulterated with rectified spirit, or with the oil of lemon, orange peel, and turpentine. These may be detected in the way previously noticed. (*See No.* 1476, *&c.*) The presence of the foreign oils, particularly the last, lessens its solubility in rectified spirit. The pure oil is freely soluble in liquor of potassa, forming a clear solution. Its specific gravity is .875 to .885.

1481. To Test the Purity of Oil of Cinnamon. The common adulterants are highly rectified spirit and oil of cassia. When pure, its specific gravity is 1.035. Oil of cassia, of which the specific gravity is 1.071 to 1.073, and when old, even 1.078 to 1.090, increases it; but before trying it, it must be tested for spirit, which has a contrary effect.

1482. To Test the Purity of Oil of Lavender. Alcohol is here also the common adulterant. The finest quality—that from the flowers, has specific gravity .877 to .905. The lightest is esteemed the best. Santaline is insoluble, or very nearly so, in the pure oil, but is freely soluble in that adulterated with alcohol. The presence of oil of turpentine, and other inferior oils, may be detected by the blotting-paper test, noticed above. (*See No.* 1475.

1483. To Test the Purity of Oil of Neroli. This is the oil of orange flowers, and is commonly adulterated with alcohol, or with the oil of orange leaf (essence de petit-grain), and generally with both. The presence of the first is easily determined (*see No.* 1476); that of the second only by comparing the odor of a drop of the suspected oil, placed on a piece of paper, with a drop of pure neroli similarly treated.

1484. To Test the Purity of Otto of Roses. Cooley says: "The common adulterants are the oils of rhodium, sandal wood, and geranium, with camphor, and occasionally with spermaceti, to give the spurious article the usual crystalline appearance. Pure otto has a bland, sweet taste; if it be bitter, it contains oil of rhodium or sandal wood; if it be pungent or bite the palate, it contains either oil of geranium or camphor, and most probably both; if it imparts an unctuous sensation to the palate, or if it leaves a greasy stain on paper, it contains spermaceti. A single drop of pure otto of roses exposed for some hours under a bell-glass, in the cold, to the vapor of a few grains of iodine, remains white, and continues so on subsequent exposure to the air. A sample adulterated with foreign oil, on the contrary, becomes yellow or yellowish-brown, and continues subsequently to darken, until it becomes of a deep brown color, or even perfectly black, according to the extent of the adulteration. A single drop of pure otto placed on a watch glass with one drop of concentrated sulphuric acid (oil of vitriol), and stirred with a glass rod, retains the purity of its color and odor; but a sample adulterated with other oil becomes more or less brown, and evolves peculiar odors—that from oil of geranium being strong and disagreeable; that from oil of rhodium being increased and rendered unctuous and cubeb-like; that from camphor, characteristic and combined with acidity; that from spermaceti, unctuous and clearly perceptible." Dr. R. Baur, of Constantinople, has had the opportunity of preparing a standard otto of rose on the spot, and was also in a position such as scarcely any other chemist ever was for investigating the whole subject. He says that pure otto gives, with iodine and with iodide of potassium and starch, the same reactions as when it is mixed with geranium oil, and even those with pure geranium oil are hardly different. He further says that many attempts have been made to discover some chemical reaction which would reveal the falsification of otto with geranium oil, but hitherto mostly in vain.

1485. To Test the Purity of Oil of Cloves. Oil of cloves is frequently adulterated with inferior essential oils, but when pure it exhibits the following results: When shaken with pure *liquor of ammonia*, it coagulates, and crystallizes after fusion by a gentle heat: Treated with an alcoholic *solution of potassa*, it congeals into a crystalline mass, with total loss of its odor: A solution of *chromate of potassa* converts it into brown flakes, whilst the salt loses its yellow color.

1486. To Test the Purity of Oil of Rue. This oil is nearly always adulterated. When pure, it forms a clear solution with *rectified spirit*; *Iodine* dissolves in it slowly, without apparent reaction beyond a darkening and a slight increase in viscidity: It is unaffected by a solution of *chromate of potassa*; *Nitric acid* very slowly changes it into a greenish yellow liquid balsam.

Fixed Oils and Fats.

These are compounds of carbon, hydrogen, and oxygen (hydrocarbons), obtained from the organic kingdom, and chiefly distinguished by their insipidity, unctuosity, insolubility in water, and being lighter than that fluid. Olive oil, obtained from the vegetable, and spermaceti oil, from the animal kingdom, may be taken as types of the rest. The fixed oils are chiefly found in the fruit and seeds of plants, and in thin membranous cells in various parts of the bodies of animals. Some of these oils are solid at ordinary temperatures; as palm oil, cocoanut oil, &c.; but the majority are fluid, except when considerably cooled, when they separate into two portions: the one solid, consisting mostly of stearine, and the other liquid, consisting chiefly of oleine. Nearly all the fixed oils, when freely exposed to the air, absorb oxygen, and either gradually harden, or become rancid. The former are termed drying oils, and are used by painters; the latter are used in cookery, for machinery, lamps, &c. The fixed oils, except where otherwise directed, are obtained from the bruised or ground fruit or seed, by means of powerful pressure, in screw or hydraulic presses, and are either allowed to clarify themselves by subsidence, or are filtered. Another method is by boiling the bruised seed in water, and skimming off the oil as it rises to the surface. This is the plan adopted for castor oil in the West Indies. The specific gravities of the fixed oils range between 0.865 and 0.970. (*Cooley.*)

1488. Davidson's Process of Deodorizing Putrid Whale Oil. This cheap method of purification consists in the employment of chloride of lime, the quantity depending on the degree of putrefaction of the whale oil. In general 1 pound is sufficient for 112 pounds oil; but if it is in a state of great putrefaction, there may be 1½ or 2 pounds required. With 1 pound chloride of lime about 12 times the quantity of water must be employed. The chloride is bruised in a mortar, and the water added by degrees till it forms a soft and liquid paste, and afterwards by the addition of the remainder of the water it takes the consistency of cream. This is to be mixed with the oil and often carefully stirred. After some hours 1 pound sulphuric acid, diluted with 20 or 30 times its bulk of water, is poured on the mixture, and the whole brought to a boil over a moderate fire, and stirred continually until drops of oil run off at the end of the stirring pole. It is then left for some hours for the oil to precipitate, and the acidulated water is drawn off. A common cast-iron boiler, with sheets of lead at the bottom, is the best for the purpose, or a copper or iron vessel may be used when the quantity of acid is not too great. The chloride of lime must not be bruised in a copper or iron mortar.

1489. To Restore Rancid Oil and Fat. Rancid oil and fat may be recovered by agitating them, at a gentle heat, with fresh-burnt and coarsely-powdered charcoal (which has been thoroughly freed from dust by sifting and fanning), followed by filtration through flannel; or by simple filtration through charcoal in bags of Canton flannel, according to the common method.

1490. To Restore Rancid Fat or Oil. Another method is to thoroughly wash them with hot water, frequently renewed, or to blow steam through them, until the desired effect be produced. Air freely employed for some time, instead of steam, succeeds admirably with many oils, and its use has the advantage of not introducing moisture into the article. Another method is to boil oil or fat, for 15 to 30 minutes, with a little water and calcined magnesia.

1491. To Prevent Oils and Fats from Becoming Rancid. The tendency of oils and fats to become rancid may be prevented, or greatly retarded, by artificial means. One of the simplest methods is to dissolve about 2 per cent. of gum-benzoin (in fine powder), or about one per cent. benzoic acid, in the oil or fat, by the aid of a gentle heat. This addition renders oils, pomades, ointments, &c., peculiarly soothing to an irritable or highly sensitive skin. It should be done before the addition of the scents. When the preparations are intended for exportation to hot climates, the percentage of the gum or acid should be somewhat increased. This is the plan generally adopted by the manufacturing perfumers and druggists. In the wholesale trade, carefully rendered lard, suet, &c.; simple pomades and oils, so prepared, are now common articles of stock and sale.

1492. An Excellent Preventive of Rancidity in Oils, &c. Nitric ether, or its alcoholic solution (sweet spirits of nitre), is highly recommended as a most effective preventive of rancidity. It is said that a few drops of the ether will effect this object, and will even remove the disagreeable odor of rancidity when present. Oil so treated, after being heated to remove the alcohol, when the solution has been used, is quite bright, clear, and scentless, if it were originally so. Poplar-buds, crushed and digested at a gentle heat, in oil or fat, will also remove, or greatly retard, its tendency to become rancid. Fatty bodies in a globular state may be kept a long time without becoming rancid. This peculiar state can be imparted to fatty matters by melting them at 130° Fahr. and adding a small quantity of yolk of egg, or bile, or albuminous substances, or best, a solution of alkali (composed of 5 to 10 parts for every 100 of oil), at the same temperature. The whole is then agitated for some time to bring the fatty matter into a globular condition.

1493. To Prevent Fats and Oils from Becoming Rancid. Heat the oil or melted fat for a few minutes with powdered slippery-elm bark, in the proportion of 1 drachm of the powder to one pound of fat. The bark shrinks and gradually subsides, after which the fat is poured off. It communicates an odor like that of the hickory-nut. *Butter* thus treated has been kept unchanged for a year.

1494. To Purify Vegetable Oil for Use in Lamps. To 100 pounds oil add 25 ounces alum, dissolved in 9 pounds of boiling water. After stirring it about half an hour, add 15 ounces nitric acid, still continuing to stir it. Let it stand 48 hours, when the fine oil will swim on the surface, and then draw it off. Such oil is used all over Continental Europe, and an equal quantity yields double the light of whale and fish-oil, without its offensive odor

1495. Bancroft's Process for Refining Lubricating Oils. Mr. Bancroft's process for refining common olive oil, lard oil, &c., for lubricating purposes, is to agitate them with from 3½ to 8 per cent. caustic soda lye, of 1.2 specific gravity. If, on trial of a small quantity, the lye be found to settle clear at the bottom, enough has been added. The oil is allowed to rest for 24 hours, for the soapy matter to subside; the supernatant oil is then filtered. (*See No.* 1551.) Another plan of purifying oils is to agitate them with a strong solution of common salt.

1496. Calvert's Tests for the Purity of Oils. In the use of the following tests, the result of a series of experiments by Mr. F. G. Calvert, he recommends especial care in the preparation of the reagents used for testing, not only as regards their exact strength and purity, but also in following strictly the prescribed method of using them, carefully noting the time required for their action and effects to become apparent.

1497. Calvert's Caustic Soda Test for Oils. A solution of caustic soda, specific gravity 1.340, is useful to distinguish fish from other animal and vegetable oils, owing to the distinct red color which the fish oil assumes; the presence of 1 per cent. of fish oil will be detected by the test. Add one volume of the test to 5 volumes of the oil, well mixed, and heated to the boiling point. *Hempseed oil* acquires a brown-yellow color, and becomes so thick as to entirely lose its fluidity. *Linseed oil* assumes a much brighter yellow color, and remains fluid. *India nut oil, gallipoli oil,* and *pale rape oils,* become a solid white mass in 5 minutes, while the other oils remain fluid.

1498. Calvert's Sulphuric Acid Tests for Oils. I. Sulphuric acid of specific gravity 1.475 will detect oils adulterated with *hempseed* and *linseed oils* to the amount of 10 per cent. *Fish oil* may be detected to the amount of 1 per cent. by the red color it assumes, this being noticed more particularly when the fish oil is allowed to separate by standing. To apply the test agitate 1 volume with 5 volumes of the oil, and allow the mixture to stand for fifteen minutes.

II. For the detection of *hemp, linseed, fish, gallipoli,* and *French nut oils,* 1 volume of sulphuric acid of specific gravity 1.530, agitated with 5 volumes of oil, and the mixture allowed to stand for 5 miuutes. Under this test the above mentioned oils alone assume a decided coloration.

III. Sulphuric acid of specific gravity 1.635, used similar to the preceding, and the effects noted after standing 2 minutes, affords a test under which the colorations are distinct and well marked, and will detect 10 per cent. of rapeseed oil in *olive oil,* of lard oil in *poppy oil,* of French nut oil in *olive oil,* and of fish oil in *neat's foot oil.*

A stronger acid than this carbonizes the oils and destroys the coloration.

1499. Calvert's Nitric Acid Tests for Oils. The successive application of nitric acid of specific gravity 1.330, and of a solution of caustic soda of specific gravity 1.340, can be successfully applied to detect the following very frequent cases of adulteration:

I. *Gallipoli oil* with fish oils; the former assumes no distinct color with the acid, and gives with soda a mass of fibrous consistency, while fish oils are colored red, and become mucilaginous with the alkali.

II. *Castor oil* with poppy oil; the former, if adulterated, acquires a reddish tinge, and the mass with the alkali loses much of its fibrous appearance.

III. *Rapeseed oil* with French nut oil; under the nitric acid test the former, if adulterated, assumes a reddish tinge, more or less intense, which alkali increases, and renders the semi-saponified mass more fibrous.

1500. To Test the Purity of Olive Oil. Cooley says: When pure olive oil is shaken in a phial only half filled, the bead or bubbles formed very rapidly disappear, but with the adulterated oil they remain much longer before they burst. If olive oil contains $\frac{1}{4}$ part of poppy oil, part of it remains liquid at 36° Fahr., its proper freezing temperature; and if it contains $\frac{1}{3}$ of poppy oil, it does not solidify at all, unless cooled much below the freezing point of water. Pure olive oil well agitated for some time with $\frac{1}{12}$ of its volume of nitric solution of mercury, becomes quite solid in 3 or 4 hours, without any separation of liquid oil. (The mercurial solution is made by dissolving 1 ounce mercury in 2 fluid ounces $1\frac{1}{2}$ drachms nitric acid specific gravity 1.500.) According to M. Boudet, 1 grain of hyponitrous acid (hyponitric?) mixed with 3 grains of nitric acid, will cause the perfect solidification of 200 grains of pure olive oil in 75 to 78 minutes.

1501. To Test the Purity of Castor Oil. Castor oil is frequently adulterated with rape oil; but this may be detected by its not dissolving in strong alcohol, and also by its less density. Pure castor oil is soluble in an equal weight of alcohol specific gravity 0.820.

1502. To Refine Olive Oil. Olive oil intended for huiles antiques (*see No.* 1244) and other like uses, is commonly refined by violently agitating it in glass or stoneware, with about $1\frac{1}{2}$ to 2 per cent. of its weight of concentrated sulphuric acid. This renders it opaque, and causes it to assume a greenish color. After about 2 weeks' repose, it deposits much coloring matter, and is then found to have acquired greater fluidity, to have become much paler, to be more emollient and glossy as a lubricator, and to burn with greater brilliancy. The clear portion is now decanted, well washed with steam or hot water, and, after sufficient repose in a close vessel, at a temperature about 60° Fahr., again decanted, and, if necessary, filtered through Canton flannel or bibulous paper. This plan is also applied to other fixed oils, and answers well for most of the recently expressed vegetable oils.

1503. To Purify and Sweeten Castor Oil. The American Journal of Pharmacy gives the following receipt for this purpose: Take 1000 parts of the oil, 25 parts purified bone-black, 10 parts calcined magnesia. Mix them carefully in a convenient vessel of glass or tinned iron, and let it stand during 3 days, with occasional agitation, and filter through paper or felt. (*See No.* 1504).

1504. To Bleach the Vegetable Oils. According to Cooley, almond, ben, castor, colza, linseed, nut, olive, poppy, rape, teel, and other like vegetable oils, are readily bleached by exposure, in glass bottles, to the light. For this purpose, 2-quart to 4-quart pale green glass or blue glass bottles filled with the oil, and covered with white gallipots inverted over them, are suitably placed, a small distance apart, on the roofs of houses or sheds, or in any other suitable position, fully exposed to the sun during the greater portion of the day, or at all events to the south-east and south. 14 to 21 days' exposure to the sun, in clear weather, during summer, is usually sufficient to decolor castor oil and almond oil; but 4, 5, or even 6 weeks, is commonly required to render linseed oil very pale. This is the common plan adopted by the wholesale druggists to whiten their castor oil, by some of the perfumers for their almond oil and olive oil, and by the oilmen for their pale linseed oil for artists. A better plan, however, when this method is adopted, is to cork the bottles loosely air-tight, but not firmly down, when the sun has been on them two or three hours, and whilst they are still heated with it. In this way the oil suffers less from the exposure than by the loose gallipot system in common use. Almond, olive, and the other sweet oils, thus treated, are apt to lose some of their blandness, and to acquire a slight sulphurous smell, and smoky flavor, whilst castor oil loses its original blandness, and assumes the strong, nauseous flavor characteristic of the white castor oil of the stores. These qualities may be removed by agitation with a little fresh animal charcoal, dry freshly prepared alumina, or calcined magnesia, and subsequent filtration; or, what is even better, though more troublesome, by well washing the oil with hot water, and subsequent repose out of contact with the air, and subsequent decantation. (*See No.* 1503.)

1505. To Bleach Vegetable Oils. Another method pursued for bleaching oils is as follows: The oil is placed in a porcelain, stoneware, or well-tinned vessel, along with some dry filtering powder, 1 to 2 pounds to each gallon of the oil, or some dry and recently prepared hydrated alumina (¼ to ½ pound per gallon of oil; but much less is often sufficient if the article be of proper quality); and the heat of steam or boiling water being applied, is vigorously stirred, with a clean wooden or stoneware spatula, for about an hour. It is then thrown into a Canton flannel oil-bag, and filtered, in the usual manner, observing to return the runnings until they become quite white and clear. This is the way perfumers and wholesale druggists usually prepare their *white almond oil*, *white olive oil*, and *white oil of ben*. Formerly fresh burnt animal charcoal was chiefly used for the purpose, and is still so employed by some houses; but the other substances answer better and are more convenient. (*Cooley.*)

1506. To Bleach Vegetable Oils. The oils referred to in No. 1504, as well as all other oils and fats, may be rendered perfectly colorless by agitating them with a little chromic acid; or, what is cheaper and more convenient, with a mixed solution of bichromate of potassa and sufficient sulphuric acid to seize on the alkali of the bichromate and to liberate its chromic acid. 1 to 2 drachms of the bichromate, mixed with 3 times its weight of oil of vitriol (previously diluted with about twice its volume of water, and allowed to cool), is ordinarily sufficient, when skillfully used, to perfectly bleach 2 or 3 pints of oil. It should be added gradually to the oil, with continued violent agitation, and this should be kept up for some considerable time after the last portion is added. The mixture must be made in a vessel of glass, porcelain, stoneware, or wood, and nothing metallic must touch it. In some cases a few drops of strong nitric acid (diluted with about twice its bulk of water), if added towards the end of the agitation, will facilitate the process; or, with colza, linseed, nut, and rape oil, instead of the diluted nitric acid, a few drops of hydrochloric acid without dilution. After the final agitation, the oil must be allowed to repose at a temperature of about 60° Fahr. When it has settled, the clear portion should be decanted, thoroughly washed with hot water, again allowed to repose for some time, and then finally decanted for use. If necessary, it may lastly be filtered. (*Cooley.*)

1507. Berlandt's Method of Bleaching Fixed Oils. Shake strongly for some minutes, 300 parts of the oil with 40 parts water containing 1 part permanganate of potassa; allow the mixture to stand in a warm place for some hours, and then filter. This renders the oil colorless.

1508. Dieterich's Method of Bleaching Fixed Oils. Dissolve 2¼ pounds (avoirdupois) permanganate of potassa in 31½ quarts water, in a wooden tub having a faucet in its bottom. Stir into the mixture 52½ quarts of the oil to be bleached, and keep all well stirred for 2 days. Then add 21 quarts boiling water and 11 pounds commercial hydrochloric acid, and keep the whole stirred for 2 days longer. Draw off the acid water, and wash the oil repeatedly with boiling water until all acid is removed from it.

1509. Engelhardt's Method of Bleaching Palm Oil. Heat 1000 parts by weight palm oil in an iron vessel to about 143° Fahr., and let it stand all night, sustaining the temperature. Next day pour it off into a clean vessel and let it cool down to about 100°. Meanwhile, dissolve 15 parts bichromate of potash in 45 parts boiling water; when the solution has cooled a little, pour into it 60 parts hydrochloric acid. Add this mixture to the palm oil, stirring quickly, and in about 5 minutes it will assume a sombre green color; by continued stirring the oil gradually clarifies and becomes quite limpid. It should become quite white after washing it with warm water; but if not entirely colorless, the operation must be repeated, using ½ part bichromate of potash, and 1 part hydrochloric acid. This is a quick method, and Engelhardt claims that it produces better results than the means usually employed. (*See No.* 537.)

1510. To Bleach Cotton Seed Oil. Use 1 gallon English caustic soda, in a solution of about 40° Baumé, to about 20 gallons crude oil. The oil, previous to being mixed with the solution, must be heated to about 90° Fahr. Stir constantly while adding the cold solution. If the oil is not now sufficiently light, add more of the solution to bring it to a light yellow or straw color.

1511. Keyer's Process for Purifying Oils. The process of M. Keyer, which is applicable to all oils, has given excellent results in a manufactory of rape seed oil. Into 1000 parts by weight of oil, put a mixture of 6 parts solution of ammonia and 6 parts water, and agitate the barrel well until the alkali is perfectly mixed, which may be done in 15 minutes. The barrel is then sealed hermetically, and, after 3 days' repose, the oil is decanted and filtered. The residue is used for the manufacture of soap. Oil thus worked contains no trace of acid, and the mucilaginous impurities are destroyed or precipitated.

1512. Liebig's Method of Obtaining Non-poisonous Oil of Almonds. Agitate the crude distilled oil with binoxide of mercury in slight excess; and, after a few days' contact, rectify the oil from a little fresh binoxide of mercury. The product is quite pure, if properly managed, as the hydrocyanic acid (the poisonous principle) of the oil, unites with the binoxide to form a bicyanide of mercury.

1513. Neat's-foot or Trotter Oil. Obtained by boiling neat's-foot, tripe, etc., in water. It is a coarse animal oil, very emollient, and much used to soften leather.

1514. To Refine Neat's-foot Oil. Put a quart of the oil with ½ pound bright lead shavings, and ½ pound quicklime pounded, into a glass bottle, let it stand in the sun and light for 2 or 3 weeks, then put the oil and lime into a saucepan with ½ pound washing soda, boil gently 15 minutes, then set in the coldest place possible till the next day, when it will be found congealed; place it into a filter of white blotting paper, place a clean glass bottle under the filter, and you will get the finest oil, suitable for the most delicate machinery. Any one requiring a little nice oil would do well to try this in preference to buying it ready done. It must be kept perfectly cold while filtering, or the soda will go through.

1515. Hirzel's Method of Preserving Animal Fats. Mix 14 pounds of recently melted fat with 5 drachms salt and 15 grains alum in fine powder; heat until a scum is formed on the surface; remove the scum, and when the clear fat is cool, wash and knead it in water, frequently changing the water, so as to remove all the salt; then evaporate the water at a heat insufficient to injure the fat.

1516. To Preserve Animal Fats for a Long Time. The following mode of benzoating all kinds of animal fats will be found the most effectual for preserving them for a long time. Make a saturated solution of gum benzoin in alcohol by simple heat, allow the liquid to settle clear, then strain and mix with equal parts of fresh castor oil. Of this mixture add 4 ounces to each gallon of fat or ointment while warm. The proportion of the solution of benzoin may be increased for pomades, as it forms, by its aromatic odor, an excellent basis for perfumes. The benzoatic fat should not be kept in tin, but in well-covered jars. Steam-rendered lard, or that treated with salt and alum, should be carefully re-melted in a water-bath, to allow all the water to settle so as to pour off the pure fat. In preparing ointment and pomades it is important that the wax should be first melted, and the oil or fat warmed before adding to the wax. This precaution, which will save much time and trouble, is often neglected by young beginners. (*See Nos.* 1253 *and* 1254.)

1517. Boillot's Process for Purifying Fats. Melt 2½ pounds avoirdupois of the fat with 2 quarts lime-water; stir actively over the fire for 2 or 3 hours, and cool. Then press in flannel and allow it to stand a day or two to harden. By melting it with acidulated water to remove the excess of lime, a hard fat results, suitable for making candles.

1518. Hog's Lard. This is obtained, like the rest of the animal fats, from the raw lard, by chopping it fine, or rather rolling it out, to break the cells in which the fat is lodged, and then melting the fat in a water-bath, or other gentle heat, and straining it while warm. Some boil them in water; but the fats thus obtained are apt to grow rank much sooner than when melted by themselves. (*See No.* 525.)

1519. To Try out Lard. This should be done in the open air. Set a large kettle over a fire, in some sheltered place, on a still day. It will cook much quicker in large quantities. Put into the kettle while the lard is cold, a little saleratus, say 1 table-spoonful to every 20 pounds; stir almost constantly when nearly done till the scraps are brown and crisp, or until the steam ceases to rise; then there is no danger of its moulding; strain out into pans, and the first will be ready to empty into crocks when the last is strained.

1520. To Detect Water in Lard. The presence of water is very easily detected by merely melting the lard, when the water collects at the bottom of the vessel as a distinct layer. The weight and volume of lard can be greatly increased by the incorporation of water with it; and purchasers of a pound of lard will frequently find that they have paid the price of the lard for as much as 4 ounces of water. Lard is also adulterated with from 2 to 5 per cent. of *milk of lime* (slacked lime mixed to a milky consistence with water); this gives the lard a beautifully white appearance, and also allows of 25 per cent. of water being stirred into it while cooling.

1521. Benzoated Lard. Take benzoin in coarse powder, 1 ounce; fresh lard, 1 pound. Heat together for 2 or 3 hours in a water-bath, and then strain.

1522. To Bleach Lard. Lard may be bleached by applying a mixture of bichromate of potassa and muriatic acid, in minute proportions, to the fat. (*See Nos.* 1509 *and* 1523, *also No.* 537.)

1523. To Bleach and Harden Tallow. In a copper boiler, put ½ gallon water, and 100 pounds rendered tallow; melt over a slow fire, and add, while stirring, 1 pound of oil of vitriol, previously diluted with 12 of water; afterwards, ½ pound bichromate of potassa, in powder; and lastly, 13 pints water, after which the fire is suffered to go down, when the tallow will collect on the surface of the dark green liquid, from which it is separated. It is then of a fine white, slightly greenish color, and possesses a considerable degree of hardness. (*See No.* 1509.)

1524. Factitious or Imitation Spermaceti. White spermaceti, 10 parts; sonorous cake stearine, 20 parts; potato starch, 5 parts; mucilage, 1 part. Melt the first three and unite well, then let the mass cool to the consistence of dough; turn it out on an oiled marble or lead slab, and roll it into a cake; next sprinkle a little mucilage on it, double it, and roll again; repeat the process as often as required; lastly allow it to cool. If it has been properly managed, it will flake when broken up, and resemble spermaceti.

1525. Extraction of Fat from Bones. A process has been adopted abroad for extracting oil and fat from bones and other animal refuse, by digesting it in a closed and heated vessel with benzole or similar hydrocarbon. After a few hours the liquid is drawn off, the hydrocarbon separated by distillation, and the oil is left ready for use. The bones may then be used for the manufacture of gelatine. This is very similar to a method lately proposed of obtaining oil from oleaginous seeds, but in this latter case, as would probably be preferable in the former, bisulphide of carbon is the menstruum employed.

Petroleum, or Crude Coal Oil.

The name of petroleum is now applied to all the native liquid substances which have a bituminous character. It consists, therefore, of an inflammable and more or less volatile oily substance, ranging in color and appearance from a yellowish white, transparent fluid, to a brown or almost black, opaque viscid mass. The former used to be called naphtha, but this name is now given to any oil of this description, whether native, or distilled from a darker grade of petroleum. The latter is the form in which the bulk of the petroleum is found in America; and this, when exposed to the air, gradually passes into *asphaltum*, or solid bitumen.

1527. To Purify Petroleum. Tank-shaped stills of a capacity of 500 to 2500 barrels are filled with crude oil, and heat applied by furnaces beneath them, causing vapors to arise, which are carried forward through pipes immersed in water, and condensed into a liquid, which runs out at the end of the pipe. The first product is gasoline, a very light hydrocarbon, marking as high as 83° and as low as 75° of Baumé's coal oil hydrometer. The heat is then somewhat increased, and the next product obtained is called *naphtha, benzine* (*not benzole*), which marks from 75° to 63° Baumé; and, when combined, will average about 67°. The heat being allowed to increase further, produces distillate, or crude burning oil. This passes over until about 8 or 10 per cent. of the original quantity contained in the still remains, which is called residuum or tar, and may be redistilled for the purpose of obtaining paraffine and lubricating oil. *Paraffine* is a fatty material, resembling sperm in appearance. The distillate or crude burning oil is converted into ordinary kerosene by a process of purification. For this purpose it is placed in a tank, where it is violently agitated by forcing air through it, and while thus agitated, 1½ to 2 per cent. sulphuric acid is added, after which the agitation is continued 15 to 30 minutes. The oil is then allowed to settle, when the acid and impurities are drawn from the bottom. The oil is then washed, first with water and then with caustic soda, by which means the remaining impurities are removed, and any acid remaining in the oil is neutralized. It is then taken to shallow bleaching tanks, where it is exposed to light and air, and allowed to settle; it is next heated by means of a coil of steam pipe running through it, to expel all gaseous vapors which will ignite at a temperature below 110° Fahr. The oil is now called a *fire test* oil, and is ready to be barreled and sent to market.

1528. To Clarify Coal Oil. Place in a close vessel 100 pounds crude coal oil, 25 quarts water, 1 pound chloride of lime, 1 pound soda, and ½ pound oxide of manganese. The mixture is violently agitated, and allowed to rest for 24 hours, when the clear oil is decanted and distilled. The 100 pounds coal oil are to be mixed with 25 pounds resin oil; this is one of the principal points in the manipulation; it removes the gummy parts from the oil, and renders them inodorous. The distillation spoken of may terminate the process, or the oils may be distilled before they are defecated and precipitated.

1529. To Decolorize Kerosene Oil. Kerosene oil is decolorized by stirring it up with 1 or 2 per cent. of oil of vitriol, which will carbonize the coloring matter, then with some milk of lime or some other caustic alkali, settling, and redistilling. The latter appears to be indispensable.

1530. Why Kerosene or Coal Oils Explode. No oil is explosive in and of itself; it is only when the vapor arising therefrom becomes mixed in the proper proportions with air, that it will explode. There should be no inflammable vapor from any oil used for burning in lamps at ordinary temperature. A volatile oil is unfit for the purpose of illumination.

1531. To Test Kerosene or Coal Oil. Burning oil is often adulterated with heavy oil, or with benzine. The adulteration with the former is shown by dimness of the flame after having burned for some time, accompanied by a charring of the wick. The latter may be readily detected by means of a thermometer, a little warm water, and a tablespoonful of the oil. Fill the cup with warm water, the temperature of which is to be brought to 110° Fahr. Pour the oil on the water; apply flame to the floating oil by match or otherwise. If the oil is unsafe it will take fire, and its use in the lamp is dangerous, for it is liable to explode. But if the oil is safe and good it will not take fire. All persons who sell kerosene that will not stand the fire test at 110° are liable to prosecution.

1532. To Extinguish the Flame of Petroleum or Benzine. Water, unless in overwhelming quantity, will not extinguish the flame of petroleum or benzine. It may, however, be speedily smothered by a woolen cloth or carpet, or a wet muslin or linen cloth, or earth or sand being thrown over it. These act by excluding the air, without which combustion cannot be maintained.

1533. To Deodorize Benzine. Shake repeatedly with plumbate of soda (oxide of lead dissolved in caustic soda), and rectify. The following plan is said to be better: Shake repeatedly with fresh portions of metallic quicksilver; let stand for 2 days, and rectify.

1534. To Manage Kerosene Lamps. These are so much used that a few hints on their management will no doubt be acceptable. There are very few common illuminating substances that produce a light as brilliant and steady as kerosene oil, but its full brilliancy is rarely attained, through want of attention to certain requisite points in its management. By following the directions here given, the greatest amount of light will be obtained, combined with economy in the consumption of the oil. The wick, oil, lamp, and all its appurtenances, must be perfectly clean. The chimney must be not only clean, but clear and bright. The wick must be trimmed exactly square, across the wick-tube, and not over the curved top of the cupola used to spread the flame; after trimming, raise the wick, and cut off the extreme corners or points. A wick cannot be trimmed well with dull scissors; the sharper the scissors, the better the shape of the flame. These hints, simple as they appear, are greatly disregarded, and the consequence is a flame dull, yellow, and apt to smoke. The burners made with an immovable cupola, and straight, cylindrical chimneys, require especial care in trimming; the wick has to be raised above the cupola, and has therefore no support when being trimmed. A kerosene lamp, with the wick turned down, so as to make a small flame, should not be placed in a sleeping room at night. A wick made of felt is greatly superior in every way to the common cotton wicks.

1535. To Keep Kerosene Lamps from Getting Greasy. The upper part of a kerosene oil lamp, after standing for a short time, frequently gets oily, from the condensation of the vapor of the oil. This will be greatly, if not entirely prevented, by taking a piece of felt and cutting a hole in it so as to fit exactly around the socket into which the burner is screwed; trim the felt off so as to leave a rim about ½ inch wide, and place this felt ring on the socket.

1536. To Cement the Socket on a Kerosene Lamp. The socket of a kerosene lamp, into which the burner is screwed, frequently becomes loose or comes off. To fasten this, take the socket off, pick out the old cement, and wash it with hot soap and water, with a little soda, to remove all trace of grease. Empty the lamp, and wash it in the same manner, especially the lip or neck which fits into the socket. Next take a cork which fits (not too tight) into the socket; grease it slightly, and screw it into the socket (the same way the burner is screwed in), until the end of the cork is nearly level with the bottom of the socket; this will leave a circular trench to receive the cement. Take the best plaster of Paris, mix it quickly as thick as it will flow, fill the trench in the socket, reverse the lamp, and press the lip of the glass firmly into the socket until the edge of the socket fits closely to the glass. This operation must be done quickly, before the plaster has had time to set. Let the whole remain about 12 hours in a warm place before using. Then unscrew the cork and scrape off any adhering plaster. (*See No.* 2260.)

1537. To Clean Vessels Used to Contain Kerosene. Wash the vessel with thin milk of lime, which forms an emulsion with the petroleum, and removes every trace of it, and by washing a second time with milk of lime and a very small quantity of chloride of lime, and allowing the liquid to remain in it about an hour, and then using it with cold water, even the smell may be so completely removed as to render the vessel thus cleansed fit for keeping beer in. At the same time the external surface of the vessel is to be washed with a rag dipped in the same substance. If the milk of lime be used warm, instead of cold, the operation is rendered much shorter. If particles of thickened petroleum adhere to the glass after the first washing, these can be removed by washing with fine sand, or by other mechanical means.

1538. To Clean Kerosene Lamps. Wash the lamp inside and out thoroughly with hot soap and water, and a little washing soda. When clean, rinse repeatedly so as to leave no trace of soap; let it drain till dry.

Lubricators.

Compounds to lessen the friction in machinery, and to prevent the bearings from rusting. Lubricators must possess a certain amount of cohesive and adhesive attraction. But they must also have the power to retain their cohesion and fluidity under the action of moderate heat, heavy pressure, and contact with metals and air. The oxygen of the air attacks many kinds of oils, rendering some acid and others resinous; and moreover some oils of mineral extraction are contaminated with acids, used in their rectification, which attack metallic surfaces, the oxides of the metals thus produced increasing friction mechanically. The oxides of metals have the power of saponifying vegetable and animal oils, and no doubt this combination often takes place when oils of this kind are used on rusty bearings. The soaps formed by the union of the saponifiable parts of oils with metallic oxides are hard and insoluble, and are, therefore, much less perfect lubricators than the oils themselves. Some oils, more particularly those extracted from petroleum, are volatile, and evaporate as soon as journals become slightly heated. Oils possessing these defects are unfit for purposes of general lubrication. Probably nothing else has ever been discovered that possesses in so high a degree all the properties desirable in a lubricator as good, pure sperm oil. There have been, however, some close approximations to it in oils extracted from petroleum. Many of the latter are, nevertheless, very inferior. Some excellent lubricating oils are also obtained from various seeds. The olive and the castor bean furnish oils very good for lubrication. Olive oil is, however, too expensive for general application to this purpose. (*See No.* 1495.)

1540. Sperm Oil as a Lubricator for Heavy Machinery. The superiority of winter sperm oil has been fully established by experiments made during 14 months, on the car and locomotive axles of a leading line of railroad; these went to prove that when using mineral, animal or fish oils, it required from 100 to 400 per cent. more of these oils to keep the temperature of the journals below 100° Fahr. than when winter sperm oil was employed; and in no instance could the pressure on the car-shaft be raised to 8,000 pounds with any other oil. It was also established that under various velocities, the amount of this oil consumed in lubrication decreased in almost the same ratio as the velocity; and as the velocity and the requisite amount of oil was diminished, the pressure could be increased without any increased consumption of oil.

1541. Booth's Axle Grease. This popular axle grease is made as follows: Dissolve ½ pound common soda in 1 gallon water, add 3 pounds tallow and six pounds palm oil (or 10 pounds of palm oil only). Heat them together to 200° or 210° Fahr.; mix, and keep the mixture constantly stirred till the composition is cooled down to 60° or 70°.

1542. Thin Axle Grease. A thinner composition than the last is made with ½ pound soda, 1 gallon water, 1 gallon rape oil, and ¼ pound tallow, or palm oil.

1543. French Liard for Lubrication. The French compound, called liard, is thus made: Into 50 parts of finest rape oil put 1 part of caoutchouc, cut small. Apply heat until it is nearly all dissolved.

1544. Bavarian Anti-Friction Composition. This composition has been employed in Munich with success and economy to diminish friction in machinery. It consists of 10½ parts pure hog's lard melted with 2 parts finely pulverized and sifted plumbago. The lard is first to be melted over a moderate fire, then the plumbago is thoroughly mixed in, a handful at a time, with a wooden spoon, and stirred until the mixture is of a uniform composition. This is applied in its cold state with a brush to the pivots, the cogs of the wheels, &c., and seldom more than once in 24 hours. It was found that this composition replaced satisfactorily the oil, tallow and tar used in certain iron-works, and saved about four-fifths of the cost of those articles.

1545. Lubricator for Wagon Axles. Tallow, 8 pounds; palm oil, 10 pounds; and plumbago, 1 pound, make a good lubricator for wagon axles. A mixture of glycerine and plumbago makes a fine liquid lubricator.

1546. Mankettrick's Lubricating Compound. 4 pounds caoutchouc dissolved in spirits of turpentine, 10 pounds common soda, 1 pound glue dissolved in 10 gallons water, 10 gallons of oil thoroughly incorporated by assiduous stirring, adding the caoutchouc last.

1547. Anti-Attrition Grease. Grind together blacklead with four times its weight of lard or tallow. This is used to lessen friction in machinery, and to prevent iron rusting. It was once a patent article. Camphor is sometimes added, 7 pounds to the cwt.

1548. Anti-Friction Grease. Boil together 1¾ cwt. tallow with 1¼ cwt. palm oil. When boiling point is reached, allow it to cool to blood-heat, stirring it meanwhile, then strain through a sieve into a solution of ½ cwt. soda in 3 gallons water, mixing it well. The above is for summer. For winter, 1¼ cwt. tallow to 1¾ cwt. palm oil. Spring and autumn, 1½ tallow, 1½ palm oil.

1549. Watchmakers' Oil. Prepared by placing a strip of clean lead in a small white glass bottle filled with olive oil, and exposing it to the sun's rays at a window for some time, till a curdy matter ceases to deposit, and the oil has become quite limpid and colorless. Used for fine work; does not get thick by age. (*See No.* 1551.) Or:—expose the finest porpoise oil to the lowest natural temperature attainable. It will separate into two portions, a thick, solid mass at the bottom, and a thin, oily supernatant liquid. This is to be poured off while at the low temperature named, and is then fit for use. Delicate clocks and watches are now lubricated with glycerine.

1550. To Prepare Oleine for Watchmakers' Use. Oleine is the liquid portion of oil and fat; by saponification it yields oleic acid. Almond or olive oil is agitated in a stout bottle with 7 or 8 times its weight of strong alcohol specific gravity .798, at nearly the boiling point, until the whole is dissolved; the solution is allowed to cool, after which the clear fluid is decanted from the stearine which has been deposited, and after filtration, the spirit is removed by distillation at a gentle heat. By exposure at a very low temperature it deposits any remaining stearine, and then becomes pure.

1551. To Refine Oil for Fine Mechanism. Refined oil for fine mechanism can be prepared by putting zinc and lead shavings, in equal parts, into good Florence olive oil, and placing in a cool place till the oil becomes colorless. (*See No.* 1495.)

Waterproofing.

Numerous plans have been invented for rendering cloth and felting waterproof; the best methods adopted are given in the following receipts:

1553. Waterproof Porous Cloth. A porous waterproof cloth is the best for outer garments during wet weather, for those whose duties or labor causes them to perspire freely. The best way for preparing such cloth is by the process adopted for the tunics of the French soldiers during the Crimean war. It is as follows: Take 2¼ pounds alum and dissolve in 10 gallons boiling water; then in a separate vessel dissolve the same quantity sugar of lead in 10 gallons of water, and mix the two solutions. The cloth is now well handled in this liquid, until every part of it is penetrated; then it is squeezed and dried in the air, or in a warm apartment, then washed in cold water and dried again, when it is fit for use. If necessary, the cloth may be dipped in the liquid and dried twice before being washed. The liquor appears curdled when the alum and lead solutions are mixed together. This is the result of double decomposition, the sulphate of lead, which is an insoluble salt, being formed. The sulphate of lead is taken up in the pores of the cloth, and it is unaffected by rains or moisture, and yet it does not render the cloth air-tight. Such cloth is also partially non-inflammable. A solution of alum itself will render cloth, prepared as described, partially waterproof, but it is not so good as the sulphate of lead. Such cloth—cotton or woolen—sheds rain like the feathers on the back of a duck.

1554. To Waterproof Tweed Cloaks. Dissolve ½ pound alum in two quarts boiling water, and pour the solution into a vessel containing 2 gallons cold spring water. Immerse the garment in this vessel, and let it remain 24 hours. Dissolve ½ pound sugar of lead in 2 quarts of boiling water, and pour the solution into another vessel containing 2 gallons of cold spring water. Take the garment from the first vessel, gently wring or press it, and immerse it in the second vessel. Let it remain 6 hours, gently wring it, and hang it in the shade to dry. This receipt has been tried, and found to answer admirably. It is very similar to the last, but only half the quantity of sugar of lead is used, and the cloth is immersed in the solutions separately.

1555. Cooley's Method of Making Cloth Waterproof. This is a simple, but perfectly successful method of rendering cloth waterproof without being, at the same time, airproof. Spread the cloth on any smooth surface, and rub the *wrong side* with a lump of bees' wax (perfectly pure and free from grease), until the surface presents a slight, but uniform, white or grayish appearance. If this be done carefully and thoroughly, a lighted candle may be blown out through the cloth, if coarse; and yet a piece of the same, placed across an inverted hat, may have several glassfulls of water poured into the hollow formed by it, without any of the liquid passing through; pressure or friction will alone make it do so.

1556. French Waterproof Felting. This composition, heretofore regarded as a secret in France, has been adopted for use in the French navy. The information regarding this material was furnished by Mr. Parent to the "Journal of Applied Chemistry." The inoxidizable compound for waterproof is made thus: 106½ parts, by weight, India rubber, 175 parts finely sifted sawdust, 10 parts powdered sulphur, 25 parts slacked lime, 125 parts sulphate of alumina, 125 parts sulphate of iron, 10 parts hemp tow. To mix the above, use heated cylinders, so as to obtain a very homogeneous paste, which is made into thin cakes, and afterward divide into small pieces to be dissolved. To dissolve this substance, take 4½ pounds spirits of turpentine, benzine, (common is preferable), petroleum, or sulphuret of carbon, to 2½ pounds of the mixture. It must be stirred 5 or 6 times during 24 hours, at the end of which time the mass will be thoroughly dissolved. The solution is then spread on the fabrics or articles to be preserved, by means of rollers, knives, or spatulas, adapted to the purpose. Apply as many coats as may be necessary, and then let it dry. As soon as the fabric is dry, it is passed under pasteboard laminating rollers, in order to give a lustre to the surface. The fabric is then rolled up on a hollow iron pipe, which is covered with cloth to prevent it sticking to the iron, and the whole placed in a copper pipe, with a perforated lid or cover; steam is then introduced at a pressure of 4 atmospheres, which pressure is maintained for 1 hour, at the end of which time the operation is ended. If it be desired to give these impermeable covers a black color, a solution of sulphate of iron, nut-gall and logwood is applied with a brush.

1557. To Make Waterproof Joint Closers. Caps or joint closers can be made of about the same materials as the above by observing the following proportions: Dissolve 21½ parts, by weight, of India rubber, in sufficient benzine; then mix with it 15 parts sawdust, 2 parts sulphur, 3 parts red lead, and 5 parts each of alum, slacked lime, and hemp tow, adding benzine to make the whole into a paste. For closing the joints on steam engines, hydraulic pumps, &c.

1558. To Render Articles Waterproof. A patent has recently been taken out in Paris for a method of rendering paper, cloth, cork, sponge, and other porous substances waterproof, as well as articles manufactured from these materials, including banknotes, envelopes, gloves, clothing, paper collars, umbrellas, labels, &c. The process consists in dissolving paraffine, cut up in small slices, in pure naphtha or benzine, entirely free from fat or oil. The solution is to be made in a vessel with a glass stopper, and is to be shaken repeatedly until the result is accomplished. An excess of paraffine should be used, so as to make sure of having a perfectly saturated solution. The articles to be treated are immersed in this for a time, according to the thickness or porosity of the tissue, and arranged to secure either a complete saturation or the penetration of the liquid to any required depth. After removal, the articles are to be dried by the application of heat, or in the air. The solvent evaporates, leaving the paper or other substance saturated with paraffine impermeable to water, and capable of resisting the action of acids. Articles of dress, such as paper collars and wristbands, should be subjected to the action of a flat-iron or heated cylinder, in order to give them a high degree of polish. The applications of this process are manifold, and new ones are constantly suggesting themselves.

1559. Balard's Waterproofing for Clothing. Balard recommends the application of acetate of alumina for the purpose of rendering clothing impervious to water. The cloth is to be immersed in a mixture of solutions of acetate of lead and sulphate of alumina; by mutual decomposition of the salts, acetate of alumina is produced on the cloth, and when the goods are dried, basic acetate of alumina adheres to the fibre, and thus protects it from the action of moisture. The process is particularly recommended for military goods.

1560. Berlin Waterproof Cloth. A firm in Berlin has for some years furnished a completely waterproof cloth, the process for making which has been kept a secret. It is now stated, however, that the method consists, in all probability, in saturating the cloth at first with a solution of sulphate of alumina and of copper, and then immersing it in a bath of water-glass and a solution of resin soap. The object of the copper seems to be to prevent the cloth from rotting or stiffening more perfectly than can be done by the alumina alone. (*See No.* 1561.)

1561. To Waterproof Linen, Canvas, &c. Three baths are prepared as follows: The first, by dissolving 1 part neutral sulphate of alumina (concentrated alum cake) in 10 parts cold water. For the second, boil 1 part light resin, 1 part soda crystals and 10 parts water, till the soda is dissolved; add ⅛ part common salt, to separate the water and collect the soap; dissolve this soap with an equal amount of good palm-oil soap in 30 parts water. This soap bath must be used hot. The third bath consists of water only. Soak the fabric thoroughly in the first, or alum bath; next pass it through the soap bath; and lastly, rinse in the water. (*See No.* 1560.)

1562. Metallic Soap. Metallic soap in linseed oil is highly recommended for coating canvas for wagon covers, tents, &c., as being not only impermeable to moisture, but remaining pliable for a long time without breaking. It can be made with little expense, as follows: Soft soap is to be dissolved in hot water, and a solution of copperas (sulphate of iron) added. The sulphuric acid combines with the potash of the soap, and the oxide of iron is precipitated with the fatty acid as insoluble iron soap. This is washed and dried, and mixed with linseed oil. The addition of dissolved India rubber to the oil greatly improves the paint.

1563. To Render Canvas Fire and Waterproof. Tents, awnings, canvas, &c., may be made fireproof as well as waterproof, by immersion in soluble glass diluted with boiling water to 25° Baumé. Before thoroughly dry, immerse in a solution of sulphate of alumina (alum cake) and sulphate of copper (blue vitriol), 1 part of each to 10 parts of water; then dry the fabric slowly in the air.

1564. Fireproofing Fabrics. A solution of 3 parts borax and 2½ parts sulphate of magnesia in 20 parts water is recommended. Or a mixture of sulphate of ammonia and sulphate of lime. Soluble glass is applicable to rendering wood and theatrical decorations less inflammable.

Honey. The sweet substance extracted by the bee from the juices of the nectaries of flowers, and deposited in the cells of wax forming the honey-comb. Pure honey consists of a syrup of uncrystallizable sugar and crystalline saccharine grains, resembling grape sugar. Virgin honey is that which flows spontaneously from the comb; ordinary honey, that obtained by heat and pressure.

1566. To Purify Honey. Take of honey, 8 pounds; water, 16 pounds; heat in a tin vessel to 212° Fahr. (not to boiling) for 1 hour; then set aside over night. Mix with fresh coarsely powdered charcoal, 2 ounces Troy, and strain through flannel, then evaporate in a steam bath, at about 175° Fahr., to the proper consistence.

Hoffmann dilutes the honey with water, adds solution of tannin as long as precipitation takes place, heats to 212°, strains and evaporates as before.

Mohr and Rebling have an unfavorable opinion of charcoal, and recommend tannin or powdered galls.

Strauss, of St. Petersburg, likewise removes an excess of tannin by means of gelatin.

1567. Rebling's Method of Purifying Honey. One half ounce of honey and ½ ounce water are mixed with ⅛ grain powdered galls, heated to boiling, and then mixed with sufficient lime-water to neutralize the acid. For the best honey it takes 2 drachms. This is merely a preliminary test to determine the necessary quantity of lime-water. A flocculent precipitate takes place, which readily separates, leaving the honey perfectly clear and of a very pale yellow color, like that of an old Rhine wine; the strained liquor must be perfectly neutral. From the quantity of lime-water necessary, the quantity of the whole lot of honey is calculated, and is then treated as follows: 1 pound avoirdupois each of honey and water are heated, 4 grains powdered galls are added; the whole well stirred, heated to boiling, and the whole quantity of lime-water added at once. The fire is immediately slackened and after a few minutes the honey, when sufficiently clear, is strained; if still acid, reheating and an addition of more lime-water will be necessary. It is to be evaporated as above.

1568. Vogel's Method of Purifying Honey. Vogel's method is to beat 5 pounds honey with the white of 1 egg till it froths, and then add water to make it of the consistence of syrup; it is next boiled until the white of egg can be skimmed off. Pour it into an upright vessel into which a faucet has been inserted near the bottom, and let it settle for some weeks—when the pure honey may be drawn off through the faucet.

1569. To Clarify Honey. Melt the honey in a water-bath, remove the scum, and pour off the clear. Less agreeable than raw honey, but not so apt to ferment and gripe.

1570. Siller's Method of Clarifying Honey. Any quantity of honey is dissolved in an equal part, by weight, of water. The liquid is allowed to boil up 4 or 6 times without skimming; it is then removed from the fire, and after being cooled, brought on several strong linen strainers, stretched horizontally, and covered with a layer of clean and well-washed sand an inch in depth. When the solution has passed through the strainers, it is found to be of the color of clear white wine; the sand being allowed to remain on the strainers, is rinsed with cold water, and the whole of the liquor is finally evaporated to the thickness of syrup.

1571. To Clarify Honey. Dissolve the honey in water, add 1½ pounds animal charcoal to every 28 pounds of honey, gently simmer for 15 minutes, add a little chalk to saturate excess of acid, if required; strain or clarify, and evaporate. *Observe.*—Honey acquires a darker color if heated in copper or iron vessels; the above processes should therefore be conducted in earthen or well-tinned copper pans.

1572. Shute's Artificial Honey. Soft water, 6 pounds; pure best honey, 3 pounds; white moist sugar, 20 pounds; cream of tartar, 80 grains; essence of roses, 24 drops. Mix the above in a brass kettle, boil over a charcoal fire 5 minutes, take it off, add the whites of 2 eggs well beaten; when almost cold, add 2 pounds more honey. A decoction of slippery elm will improve the honey if it be added while cooling, but it will ferment in warm weather and rise to the surface.

1573. Cuba Honey. Good brown sugar, 11 pounds; water, 1 quart; old bee honey in the comb, 2 pounds; cream of tartar, 50 grains; gum-arabic, 1 ounce; oil of peppermint, 5 drops; oil of rose, 2 drops. Mix and boil 2 or 3 minutes and remove from the fire. Have ready, strained, 1 quart water in which a table-spoonful of pulverized slippery elm bark has stood sufficiently long to make it ropy and thick like honey. Mix this into the kettle with egg well beat up. Skim well in a few minutes, and when a little cool add 2 pounds nice strained bees' honey, and then strain the whole, and you will have not only an article which looks and tastes like honey, but which possesses all its medical properties. (The slippery elm will ferment in warm weather and rise to the surface.)

1574. Artificial Honey. Take 10 pounds Havana sugar, 4 pounds water, 40 grains cream of tartar, 10 drops essence of peppermint, and 3 pounds honey; first dissolve the sugar in the water over a slow fire, and take off the scum. Then dissolve the cream of tartar in a little warm water, and add, with some stirring; then add the honey, heated to a boiling point; then add the essence of peppermint; stir for a few moments, and let it stand until cold, when it will be ready for use.

1575. Excellent Honey. Take 5 pounds good common sugar, 2 pounds water, gradually bring to a boil, skimming well; when cool, add 1 pound bees' honey and 4 drops of peppermint. If you desire a better article use white sugar and ½ pound less water and ½ pound more honey.

1576. To Test the Purity of Honey. Honey is frequently adulterated with molasses, potato-sugar syrup, starch, wheat flower, and water. The molasses may be detected by the color and odor; the potato-sugar syrup, by boiling a sample of the honey for a short time in water containing 2 or 3 per cent. of caustic potassa; if the liquid remains colorless it is pure; but if it turns brown, more or less, it is adulterated according to the quantity of syrup present. The starch, by the honey not forming a nearly clear solution with cold water, and striking a blue color with iodine. When it contains wheat flour and is heated, it at first liquefies, but on cooling it becomes solid and tough. Water is added to honey to increase its bulk. Its presence may be suspected from the greater thinness of the liquid.

Bees' Wax. The substance which forms the cells of bees; obtained by melting the comb in water after the honey has been removed, straining the liquid mass, remelting the defecated portion, and casting into cakes. Bees' wax, when pure, has neither taste nor smell; it melts at about 157° Fahr., and is of a specific gravity of .966. It burns without smoke or disagreeable odor. It is insoluble in water, but soluble in all proportions in the fixed and volatile oils, bisulphide of carbon, and benzine. Its complete solution in these substances demonstrates its freedom from fecula, sulphur, sawdust, or bone dust, which have been found in the wax of commerce, sometimes amounting to 60 per cent. of the whole weight. The abundance and low price of paraffine have made this substance one of the principal articles used in the falsification of wax, and perhaps of all others it is the least objectionable, being without marked physiological effect upon the system.

1578. To Bleach Wax. Pure white wax is obtained from the ordinary bees' wax by exposure to the influence of the sun and weather. The wax is sliced into thin flakes, and laid on sacking or coarse cloth, stretched on frames, resting on posts to raise them from the ground. The wax is turned over frequently, and occasionally sprinkled with soft water, if there be not dew and rain sufficient to moisten it. The wax should be bleached in about 4 weeks. If, on breaking the flakes, the wax still appears yellow inside, it is necessary to melt it again, and flake and expose it a second time, or even oftener, before it becomes thoroughly bleached. The time required being mainly dependent on the state of the weather. There is a preliminary process, by which, it is claimed, much time is saved in the subsequent bleaching; this consists in passing melted wax and steam through long pipes, so as to expose the wax as much as possible to the action of the steam; thence into a pan heated by a steam bath, where it is stirred thoroughly with water and then allowed to settle. The whole operation is repeated a second and third time, and the wax is then in a condition to be more readily bleached.

1579. To Bleach Wax. Wax cannot be bleached with chemicals; if any other agent but sunshine is employed, part of its properties will be destroyed, and it is genuine wax no longer. Chlorine will whiten, but at the same time greatly injure it. The chlorine is retained, and forms, on combustion, muriatic acid.

1580. French Method of Bleaching Bees' Wax. The wax is melted in copper vessels, and, after complete liquefaction, is agitated with 8 ounces of pulverized cream of tartar for each 100 pounds. After some minutes' agitation it is allowed to deposit its impurities, and is drawn into a wooden vessel and allowed to deposit a further amount of foreign substance—dirt, sand, bees, etc.—and, while still liquid, is drawn upon a little roller partly immersed in water, to which a regular rotation is given—thus producing thin sheets or ribbons of wax, which may be detached from the roller, being now ready for the process of bleaching. This is accomplished by the exposure of the yellow scales and ribbons, upon cloths, to the direct rays of the sun and the dew, for several days, during which time the wax completely loses its color. It is, however, in practice impossible to bleach the wax at a single operation, as the effect takes place only on the surface, and, as the ribbons have a certain thickness, it is necessary to melt them anew, and having repeated the operation of granulating, it is submitted to a second exposure. The wax thus bleached is melted, and cast into discs of 1 to 2 ounces weight, and forms the cera alba of the Pharmacopœia.

1581. Italian Method of Bleaching Bees' Wax. The yellow wax is first melted in a kettle, and then is dipped out into a long tin vessel that will hold 2 or 3 gallons, and which has a row of small holes, about the diameter of a knitting-needle, in the bottom. This vessel is fixed over a cylinder of wood 2 feet in length and 15 inches in diameter, which is made to revolve like a grindstone, in one end of a trough of water 2½ feet in width, 10 to 15 feet in length, and 1 foot in depth. As the melted wax falls in small streams on this wet revolving cylinder, it flattens out into a thin ribbon and floats off toward the other end of the trough of water. It is then dipped out with a skimmer (that may be made of osier twigs), spread on a table (with a top made of small willow rods, covered with a clean white cloth), and then exposed in this way to the sun until bleached.

1582. To Detect Spermaceti in Wax. The presence of spermaceti in what is sold as virgin wax, is shown by its reduced melting point, its bending before it breaks, and by its flavor when chewed.

1583. To Detect Japanese Wax in Bees' Wax. According to Hager, this is determined by their different behavior in a concentrated solution of borax, at the boiling point. Bees' wax is totally insoluble in such a solution, while Japanese wax dissolves, and on cooling forms a milky white, gelatinous mass. From a mixture of the two the latter is dissolved out, carrying with it a portion of the former, while another portion rises and congeals on the surface.

1584. To Refine Bees' Wax. Crude wax, especially that imported, is generally loaded with dirt, bees, and other foreign matter. To free it from these substances, it undergoes the operation of refining. This is done by melting the wax along with about 3 per cent. of water in a bright copper boiler, preferably heated by steam, and after the whole is perfectly liquid, and has boiled for a few minutes, withdrawing the heat, and sprinkling over its surface a little oil of vitriol, in the proportion of about 3 or 4 fluid ounces to every 100 pounds of wax. This operation should be conducted with great care and circumspection; as, if done carelessly, the melted wax will froth up, and boil over the sides of the pan. The acid should also be well scattered over the whole surface. The melted wax is next covered over, and left for some hours to settle, or till it becomes sufficiently cool to be drawn off into the moulds. It is then very gently skimmed with a hot ladle, and bailed or decanted into basins, where it is left to cool. Great care must be taken not to disturb the sediment. When no more clear wax can be drawn off, the remainder in the melting pan is allowed to cool, and the cake or foot, as it is called, is taken out, and the impurities (mostly bees) scraped from its under surface. The remaining portion is usually reserved for a second operation, but, if required, may be at once melted, and strained through canvas into a mould. The great art in the above process is to produce a wax which shall at once be bright or semi-translucent in thin pieces, and good colored. The former is best insured by allowing the melted mass to settle well, and by carefully skimming and decanting the clear portion without disturbing the sediment. It should also not be poured into the moulds too warm, as, in that case, it is apt to separate, and the resulting cakes to be streaky, or of different shades of color. It should also be allowed to cool very slowly. When cooled rapidly, especially if a current of air fall upon its surface, it is apt to crack and form cakes full of fissures. Some persons who are very nice about their wax, have the cakes polished with a stiff brush when quite cold and hard. It is necessary to have the cans, ladles, and skimmers used in the above process kept quite hot, as without this precaution the wax cools, and accumulates upon them in such quantity as to render them inconvenient, and often quite useless, without being constantly scraped out.

1585. To Refine Wax. Another method of refining crude wax, and which produces a very bright article, is to melt it with about 1 per cent. of concentrated nitric acid, in a large earthen or stoneware vessel, heated by steam or a salt-water bath, and to continue the boiling till nitrous fumes cease to be evolved, after which the whole is allowed to settle, and treated as before.

1586. To Color Bees' Wax. Much of the imported wax has a pale dirty color, which renders it, no matter how pure, objectionable to the retail purchaser. Such wax undergoes the operation of coloring. This is done as follows:—A small quantity of the best roll annotto, cut into slices (¼ pound, more or less, to 1 cwt. wax, depending on the paleness of the latter), is put into a clean boiler with about a gallon of water, and boiled for some time, or till it is perfectly dissolved, when a few ladlefuls of the melted wax are added, and the boiling continued till the wax has taken up all the color, or till the water is mostly evaporated. The portion of wax thus treated has now a deep orange color, and is added in quantity as required to the remainder of the melted wax in the larger boiler, till the proper shade of color is produced when cold, observing to well mix the whole, and to cool a little now and then to ascertain when enough has been added. The copper must be then brought to a boil, and treated with vitriol, &c., as before. (*See No.* 1584.)

1587. To Color Bees' Wax. Another method is to add bright palm oil to the wax till it gets sufficient color; but this plan is objectionable from the quantity required for the purpose being often so large as to injure the quality of the wax; besides which the color produced is inferior, and less transparent and permanent.

1588. Factitious, or Imitation Bees' Wax. Yellow resin, 16 pounds; hard mutton suet or stearine, 8 pounds; palm oil, 2½ pounds; melt together.

II. As last, but substitute turmeric, 1 pound, for the palm oil.

III. Best annotto, 6 ounces, or sufficient to color; water, 1 gallon; boil till dissolved, add hard mutton suet or stearine, 35 pounds; yellow resin, 70 pounds; boil with constant agitation till perfectly mixed and of a proper color, and as soon as it begins to thicken, pour it out into basins to cool. When cold rub each cake over with a little potato starch. Used instead of wax in ointments by farriers.

1589. Braconot's Method of Making Artificial Wax. Any animal grease or tallow is liquefied by oil of turpentine, and poured into small round boxes lined with felt in the inside, with a number of small holes bored in the sides and the bottom. From these little boxes the liquid is pressed out gradually, but sufficiently to get rid of the turpentine oil and all the fluidity. The firm mass remaining must be washed a long time in water, to take away the smell of the oil of turpentine, and then kept fluid for several hours with animal charcoal freshly prepared and afterwards filtered whilst boiling. When cooled, it is a substance beautifully white, half transparent, dry, brittle, and free from taste or smell; and will mix well with chlorine or muriatic acid, or with ⅕ of wax to give it the necessary suppleness. In this state the mass can be made into candles not to be distinguished from wax lights. The turpentine is separated from the other oil, and evaporated by means of distillation; and this oil, when purified and whitened with animal charcoal, is of great service in the preparation of a soap extremely well adapted for the trade and for household purposes. This animal oil, when saponified with potash, and then by means of the sulphuric acidulated soda often contained in the mother lye, can be changed into a hard soda soap. There is also a sulphate of potash, much in demand in the alum works, to be obtained from it.

1590. Modeling Wax. This is made of white wax, which is melted and mixed with lard to make it malleable. In working it, the tools and the board or stone are moistened with water, to prevent its adhering; it may be colored to any desirable tint with dry color.

1591. Wax for Polishing Floors. To prepare this, 12½ pounds yellow wax, rasped, are stirred into a hot solution of 6 pounds good pearl-ash, in rain water. Keeping the mixture well stirred while boiling, it is first quiet, but soon commences to froth; and when the effervescence ceases, heat is stopped, and there are added to the mixture, while still stirring, 6 pounds dry yellow ochre. It may then be poured into tin cans or boxes, and hardens on cooling. When wanted for use, a pound of it is diffused in 5 pints boiling hot water, and the mixture well stirred, applied while still hot to the floor by means of a paint-brush. It dries in a few hours, after which the floor is to be polished with a large floor-brush and afterwards wiped with a coarse woolen cloth. A coat of this paint will last six months.

Cheese. The materials employed in making cheese are milk and rennet. The milk may be of any kind, from the poorest skimmed milk to that rich in cream, according to the quality of the cheese required. The poorest kind of cheese is made from the former, and the finer from the latter, to which additional cream is frequently added. The materials being ready, the greater portion of the milk is put into a large tub, and the remainder sufficiently heated to raise the whole quantity to the temperature of new milk. The whole is then whisked together, the rennet (*see No.* 1595) added, and the tub covered over. It is now allowed to stand until completely turned, when the curd is struck down several times with the skimming-dish, after which it is allowed to subside. The vat covered with cheese-cloth is next placed on a horse or ladder over the tub, and filled with curd by means of the skimmer; the curd is pressed down with the hands, and more added as it sinks. This process is repeated until the curd rises to about 2 inches above the edge. The cheese thus partially separated from the whey is now placed in a clean tub, and a proper quantity of salt added, or the salt is added to it without removing it from the vat, after which a board is placed over and under it, and pressure applied for 2 or 3 hours. The cheese is next turned out and surrounded by a fresh cheese-cloth, and pressure again applied for 8 or 10 hours, when it is commonly removed from the press, salted all over, and pressed again for 15 to 20 hours. The quality of the cheese especially depends on this part of the process, as, if any of the whey be left in the cheese, it will not keep, but will rapidly become bad flavored. Before placing it in the press the last time, the edges should be pared smooth and sightly. It now only remains to wash the outside of the cheese in warm whey or water, wipe it dry, color it with annotto, and place it in a cool place to mature or ripen.

1593. To Collect the Curd in Making Cheese. There are several methods adopted of collecting the curd, and as the flavor of the cheese varies accordingly, it is as well to notice them. One way is to break the curd early, and to remove the whey as soon as possible; another plan is to gather it with the hands very gently towards the sides of the tub, letting the whey run off through the fingers until it becomes cleared, and ladling it off as it collects. A third method is to remove it as quickly as possible with the curd-skimmer. Of these the second plan is said to be the best, as it preserves the oily particles, many of which are lost by the other methods.

1594. To Make Cream Cheese. This is made either of the "strippings" (the last of the milk drawn from the cow at each milking), or of a mixture of milk and cream. It is usually made up into small pieces, and a gentle pressure, as that of a 2 or 4 pound weight, applied to press out the whey. After twelve hours, it is placed upon a board or wooden trencher, and turned every day, until dry. In about three weeks it will be ripe. Nothing but raw cream, turned with a little rennet (*see No.* 1595) is employed, when a very rich cheese is wanted. A little salt is generally added, and frequently a little powdered lump sugar. The vats employed for cream cheeses are usually square, and of small size.

1595. Rennet. The stomach of the calf, freed from the outer skin, fat, and useless membrane, is washed, treated with either brine or dry salt for a few hours, and then stretched out upon a stick and hung up to dry. It is employed for curdling milk. A piece of the requisite size is cut off and soaked for some hours in whey or water, after which the whole is added to the milk slightly warmed, or, if necessary, heated to about 120° Fahr. In a short time the milk separates into a white curd, and a yellowish fluid called whey. 2 square inches from a good rennet are sufficient for a cheese of 60 pounds.

1596. Essence of Rennet. Knead together 12 ounces fresh rennet cut small, and 3 ounces common salt; leave the mixture for 5 or 6 weeks in a cool place; then add 18 ounces water, and 2 ounces good rum or proof spirit. Digest for 24 hours; filter, and color with a little burnt sugar. 2 or 3 teaspoonfuls will curdle a quart of milk.

1597. Condensed Milk. There is no difficulty in manufacturing condensed milk, and the process consists only in careful evaporation, addition of sugar, and sealing up of the article. The evaporation should be conducted in a vacuum, to prevent the milk from becoming brown and acquiring a bitter taste. It is best to stir it constantly, or the skin of coagulated casein at the top will prevent quick evaporation. When sufficiently thick or condensed it is mixed with ¼ its weight of granulated sugar, stirred well, filled in tins, and soldered up.

Preservatives.

These consist of such substances or methods as are employed for preventing decay in fruits, meat, and other perishable matter; together with valuable antiseptics.

1599. To Dry Fresh Meat. Cut the flesh into slices from 2 to 6 ounces in weight, immerse a small portion at a time in boiling water for 5 or 6 minutes, using only just water enough to cover the meat, and adding fresh water only to keep the liquor up to its original quantity. Lay the meat to dry on open trellis-work in a drying stove, keeping the temperature at about 122° Fahr. In about two days the meat will be completely dry, having lost about ⅝ its weight. Add a little salt and spice, especially coriander, to the liquor or soup in which the meat was immersed, and then evaporate it to a gelatinous consistence. When the flesh is perfectly dry, dip it, piece by piece, in the gelatinous matter liquefied by a gentle heat, and replace it in the stove to dry, repeating this varnishing and drying 2 or 3 times, so as to get the coating uniformly thick. Meat thus dried will keep good for a year.

1600. To Smoke Meat. This process consists in exposing meat, previously salted, to wood-smoke, in an apartment (usually called a smoke-house), into which the smoke is admitted by flues at the bottom of the side walls. The meat absorbs the pyroligneous acid of the smoke, and gets dried at the same time. It may be protected from soot by rubbing over with bran, or wrapping in a cloth. The smoke from oak or beech wood is preferable; and the smoking is better slow and gentle than rapid and powerful; the latter plan being too often adopted from motives of economy. Hams thus prepared, as is often the case, are ham merely on the surface, and corned pork inside. This process is sometimes imitated by immersing the meat for a few hours in diluted pyrolygneous acid, but it is apt to harden or toughen the meat.

1601. Smoking Fluid. One drop of creosote in a pint of water imparts a smoky flavor to fish or meat dipped into it for a few minutes.

1602. To Dry-Salt and Pickle Meat. This is best performed by well rubbing the meat with a mixture of salt, 2 pounds; saltpetre, 2 ounces; and moist sugar 1½ ounces, till every crevice is thoroughly penetrated, after which it should be set aside till the next day, when it should be covered with fresh salt in such parts as require it. It may then be advantageously placed in any proper vessel, and subjected to pressure, adding a little fresh salt as necessary, and turning it daily till sufficiently cured. When the brine as it forms is allowed to drain from the meat, the process is called dry-salting; but when, on the contrary, it is allowed to remain on it, the article is said to be wet-salted. On the small scale, the latter is most conveniently performed by rubbing the meat with salt, &c., as above, and after it has lain a few hours, putting it into a pickle formed by dissolving 4 pounds salt, ½ or 1 pound sugar, and 2 ounces saltpetre in 2 gallons water. This pickling liquor gets weaker by use, and should therefore be occasionally boiled down a little and skimmed, at the same time adding some more of the dry ingredients.

1603. Pickle to Give Meat a Red Color. Mix brown sugar, bay salt, common salt, each 2 pounds; saltpetre, 8 ounces; water, 2 gallons; this pickle gives meat a fine red color, while the sugar renders it mild and of excellent flavor. Large quantities are to be managed by the above proportions.

1604. To Salt Meat by Injection. The sooner meat is salted after being killed, the better, as it then possesses considerable absorbent power, which it gradually loses by age. On this property is based the process of M. Gannel for the preservation of animals intended for food in a fresh state. This operation consists in injecting a solution of chloride of aluminum at 10° Baumé, into the carotid, by means of a syphon, as soon as the blood ceases to flow from the slaughtered animal, both extremities of the jugular vein being previously tied. 9 to 12 quarts of the solution are sufficient for an ox. When the animal has been well bled, and the injection skillfully performed, it is scarcely perceptible that the animal has undergone any preparation. The injected animal is cut up in the usual way; and when intended to be eaten within 2 or 3 weeks, merely requires to be hung up in a dry situation free from flies; but if it is to be kept for a longer period, it is directed to be washed with a mixed solution of common salt and chloride of aluminum at 10° Baumé, and then simply dried and packed in clean air-tight barrels, and kept in a cool, dry place. If the air cannot be perfectly excluded, it should be packed in dry salt, not for the purpose of preserving it, but to prevent the meat from becoming musty from exposure and the action of moisture. Meat preserved by this process may be kept for several years, and merely requires soaking for 24 hours in water, for the purpose of swelling its pores, to give it the appearance and taste of fresh meat, fit either for roasting or boiling.

1605. Pelouze's Process of Preserving Meat. The meat is to be cut up into pieces of convenient size, and subjected to an atmosphere of carbonic oxide under pressure. After this a current of dry air is passed over the meat, so as to carry off all the moisture, and this being accomplished, a solution either of salt or saltpetre, or much diluted carbolic acid, is to be brought into contact with it, and the mass then sealed up in a tight vessel.

1606. To Cure Hams. Cover the bottom of the cask with coarse salt, lay on the hams with the smooth or skin side down, sprinkle over fine salt, then another layer of hams, and so continue until the cask is full. This ought to be of the larger kind. A cask holding 64 gallons is small enough, and it would be better if it held 120 gallons. Make a brine in the following proportions: 6 gallons water, 9 pounds salt, 4 pounds brown sugar, 3 ounces saltpetre, 1 ounce saleratus. Scald and skim, and when cold pour the brine into the cask until the hams are completely covered. The hams should remain in this pickle at least three months, and a little longer time would do them no harm. A handful each of mace and cloves scattered in the brine will greatly improve the flavor of the meat.

1607. To Cure Beef and Pork. To each gallon of water add 1½ pounds salt, ½ pound sugar, ½ ounce saltpetre, and ½ ounce potash. Let these be boiled together until all the dirt from the sugar rises to the top and is skimmed off. Then throw it into a tub to cool, and when cold, pour it over the beef or pork, to remain the usual time, say 4 or 5 weeks. The meat must be well covered with pickle, and should not be put down for at least 2 days after killing, during which time it should be slightly sprinkled with powdered saltpetre, which removes all the surface blood, &c., leaving the meat fresh and clean. Some omit boiling the pickle, and find it to answer well, though the operation of boiling purifies the pickle by throwing off the dirt always to be found in salt and sugar. Ham cured in this manner may be smoked as usual, and will be found excellent. This receipt has been tried with complete satisfaction.

1608. Brine or Pickle for Pork, &c. Brown sugar, bay salt, common salt, of each 2 pounds; saltpetre, ½ pound; water, 1 gallon. Boil gently and remove the scum. Another meat pickle is made with 12 pounds salt, 2 pounds sugar or molasses, ½ pound nitre, and sufficient water to dissolve it. To cure hams, mix 5 ounces nitre with 8 ounces coarse sugar; rub it on the ham, and in 24 hours rub in 2 pounds salt, and in two weeks 2 pounds more. The above is for a ham of 20 pounds; it should lie in the salt a month or 5 weeks.

1609. Liebig's Extract of Meat. Cut the lean of fresh-killed meat very small, put it into 8 times its weight of cold water, and heat it gradually to the boiling point. When it has boiled for a few minutes, strain it through a cloth, and evaporate the liquor gently by water-bath to a soft mass. 2 pounds meat yield 1 ounce extract. Fat must be carefully excluded, or it will not keep.

1610. To Preserve Meat with Vinegar. This may be done either by washing the meat, drying and laying in strong vinegar; or by being boiled in the vinegar, leaving it in the vinegar until cold, and then set aside in a cool cellar, where it will keep sound for several months.

1611. To Can Meat. Remove the bones from fresh meat, parboil the flesh, put it into a clean tin can, and fill up with rich seasoned soup; solder on the lid, pierced with a very small hole. Next put the tin into a bath of brine and heat until the steam issues from the hole; then solder up and at the same time remove the can from the bath. In a short time the pressure of the air will induce a slight concavity of the top and bottom of the can. If the process has been successfully performed, this concavity will be permanent; but if, at any future time, the concavity has ceased, or the ends become slightly convex, it is a sure sign that the meat has become putrid. The system of canning has been in later years applied to preserving fresh fruits and vegetables, and is done on substantially the same principles, namely, filling the can with steam, and hermetically sealing before the steam condenses. (*See No.* 1634.)

1612. To Keep Meat Fresh. Place the meat on a wooden support (or suspend it) in a close vessel, on the bottom of which some strong acetic acid has been poured. In this way it may be kept fresh for a considerable time.

1613. Preservation of Hams. Most grocers, dealers in hams, and others, who are particular in their meat, usually take the precaution to case each one, after it is smoked, in canvas, for the purpose of defending it from the attacks of a little insect, the dermestes lardarius, which, by laying its eggs in it, soon fills it with its larvæ, or maggots. This troublesome and expensive process may be altogether superseded by the use of pyroligneous acid. With a painter's brush, dipped in the liquid, one man, in the course of a day, may effectually secure two hundred hams from all danger. Care should be taken to insinuate the liquid into all the cracks, &c., of the under surface. This method is especially adapted to the preservation of hams in hot climates.

1614. To Make Carbolic Acid Paper for Preserving Meats. Carbolic acid paper, which is now much used for packing fresh meats, for the purpose of preserving them against spoiling, is made by melting 5 parts stearine at a gentle heat, and then stirring in thoroughly 2 parts carbolic acid; after which 5 parts melted paraffine are to be added. The whole is to be well stirred together until it cools; after which it is melted and applied with a brush to the paper, in quires, in the same way as in preparing the waxed paper so much used in Europe for wrapping various articles. (*See Nos.* 1936 *and* 1938.)

1615. To Preserve Fish Fresh with Sugar. A method adopted in Portugal for preserving fish consists in cleaning and sprinkling sugar over the interior, keeping the fish in a horizontal position, so that the sugar may penetrate as much as possible. It is said that fish prepared in this way can be kept completely fresh for a long time, the savor being as perfect as if recently caught. Salmon thus treated before salting and smoking possess a much more agreeable taste; a table-spoonful of sugar being sufficient for a five-pound fish.

1616. Aseptin. A substance called aseptin has recently been introduced into trade by a Swedish dealer as a preservative material for milk, meat, etc. This is said to be simply boracic acid, or borax; the double aseptin consisting of two parts of borax to one part of alum. Putrefaction is said to be prevented by the addition of this preparation, but mouldiness in animal substances is not. Although a very short time has elapsed since aseptin has been brought into notice, thousands of pounds are now sold almost daily in Scandinavia and Germany.

1617. **Sportsman's Beef.** Take a fine round of beef, 4 ounces saltpetre, ¾ ounce allspice, rub it well on the beef, and let it stand 24 hours; then rub in as much common salt as will salt it. Lay it by 12 days, turning it every day; then put it into a pan, such as large pies are baked in, with 3 or 4 pounds beef-suet, some under, some over. Cover it with a thick crust, and bake it for 6 hours. It will keep for 2 months, and most excellent it is.

1618. **Preservation of Meat.** By repeatedly immersing the meat in hydrochloric acid, subsequently drying, it is sufficiently cured to keep for a considerable time. When required for use, the acid must be neutralized by a little carbonate of soda, by which it will be salted. The strength of the hydrochloric acid must be determined by experiment.

1619. **To Keep Dead Poultry, &c., Fresh.** Dead birds may be preserved in a fresh state for some time by removing the intestines, wiping the inside out quite dry with a towel, and then flouring them. A piece of blotting paper, on which one or two drops of creosote have been placed, is now to be put inside them, and a similarly prepared piece of paper tied round them. They should then be hung up in a cool dry place, free from the attacks of flies or vermin, and will be found to keep much longer than without undergoing this process. (*See No.* 1614.)

1620. **To Preserve or Cure Butter.** Melt the butter in well glazed earthen pans, at a heat not exceeding 180° Fahr. in a water bath, and keep it heated, skimming it from time to time, until the butter becomes quite transparent, then pour off the clear into another vessel, and cool it as quickly as possible by surrounding it with cold water or ice. The above is the method of preserving butter employed by the Tartars who supply the Constantinople market, and in this state it may be preserved perfectly fresh for 6 months, if kept in a close vessel and a cool place. This plan received the approval of Thenard, as well as Mr. Eaton; the latter states that butter melted by the Tartar method, and then salted by ours, will keep good and fine-tasted for 2 years. Any of the following methods of salting may be adopted.

1621. **To Preserve Butter by Salting.** Mix well together 1 ounce each saltpetre and white sugar, and 2 ounces best salt, all in very fine powder, then add 1 ounce of this mixture to every pound of butter, and thoroughly incorporate them together. The butter thus prepared is then to be tightly pressed into clean glazed earthenware vessels, so as to have no vacant spaces. This butter does not taste well before it has stood for 2 or 3 weeks, after which it acquires a rich marrow flavor, which no other butter ever possesses. Any good well-made fresh butter, free from butter-milk, will succeed by this method, but the application of it to butter clarified by the Tartar plan, as described above, produces an article that will keep longer good than butter cured by any other process yet discovered.

1622. **To Preserve Butter by Salting.** Take fresh butter, 16 pounds; salt, 1 pound. Or: Fresh butter, 18 pounds; salt, 1 pound; saltpetre, 1¼ ounces; honey or fine brown sugar, 2 ounces. Proceed as in the last receipt.

1623. **To Preserve Butter from the Air.** The best method to preserve butter from the air, is to fill the pots to within an inch of the top, and to lay on it common coarse-grained salt, to the depth of ½ or ¾ inch, and then to cover the pot up with any flat article that may be convenient. The salt, by long keeping, will run to brine, and form a layer on the top of the butter, which will effectually keep out the air, and may at any time be very easily removed by turning the pot on one side.

1624. **To Preserve Butter Sweet.** To every 20 pounds of butter take 3 pounds salt, 1 pound loaf sugar, ½ pound pulverized saltpetre; mix, and put a layer of butter about 8 inches thick, then sprinkle on a light covering of the above preparation alternately, until your cask is full. Pack in air-tight casks. Butter packed in this way will keep sweet for 2 or 3 years.

1625. **To Restore Rancid Butter.** Rancid butter may be restored by melting it in a water-bath with some fresh-burnt and coarsely powdered animal charcoal (which has been thoroughly freed from dust by sifting) and straining it through clean flannel. A better and less troublesome method is to well wash the butter, first with good new milk, and next with cold spring water. Butyric acid, on the presence of which rancidity depends, is freely soluble in fresh milk.

1626. **To Improve Strong Butter.** This operation is extremely simple and practicable; it consists in beating the butter in a sufficient quantity of water, in which put 25 to 30 drops chloride of lime to 2 pounds of butter. After having mixed it till all its parts are in contact with the water, it may be left in it for 1 or 2 hours, afterwards withdrawn, and washed in fresh water. The chloride of lime, having nothing injurious in it, can with safety be augmented; but it will generally be found that 12 to 14 drops to a pound of butter are sufficient. Butter, the taste and odor of which were insupportable, has been sweetened by this simple means. We have tried the above receipt, and find that the chloride removes the rancid taste of the butter, making it suitable for cooking, but scarcely purified enough for table use.

1627. **To Preserve Milk.** The following receipt appears in Cosmos: "To every liter (about 1 quart) of unskimmed milk, previously poured into a well-annealed glass bottle, add 40 centigrammes (about 6 grains) of bicarbonate of soda. Place the bottle (which must be well corked) containing the milk for about 4 hours in a water-bath, heated to 194° Fahr. On being taken out, the bottle is to be varnished over with tar; and in that state the milk contained in it will keep sound and sweet for several weeks."

1628. To Keep Milk Sweet. A teaspoonful of fine salt or horse-radish in a pan of milk will keep it sweet for several days. Milk can be kept a year or more as sweet as when taken from the cow by the following method: Procure bottles, which must be perfectly clean, sweet, and dry; draw the milk from the cow into the bottles, and as they are filled, immediately cork them well, and fasten the cork with pack-thread or wire. Then spread a little straw in the bottom of a boiler, on which place the bottles, with straw between them, until the boiler contains a sufficient quantity. Fill it up with cold water, and as soon as it begins to boil, draw the fire and let the whole cool gradually. When quite cold, take out the bottles and pack them in sawdust in hampers, and stow them away in the coolest part of the house.

1629. Preservation of Eggs. When newly laid, eggs are almost perfectly full, but the shell is porous, and the watery portion of its contents begins to evaporate through its pores the moment it is exposed to the air, so that the eggs become lighter every day. To preserve the interior of the egg in its natural state, it is necessary to seal up the pores of the shell air-tight. This may be done by dipping them in melted suet, olive oil, milk of lime, solution of gum-arabic, or covering them with any air-proof varnish. They are then packed in bran, oats, meal, salt, ashes, or charcoal powder.

1630. To Preserve Eggs. Vegetable oils, more especially linseed, simply rubbed on to the egg, hinders any alteration for a sufficiently long period, and presents a very simple and efficacious method. We believe that two coatings of collodion should preserve eggs better than any other method that has yet been suggested. Or perhaps a single coating of paraffine might be equally effective.

1631. To Distinguish Good Eggs. To ascertain whether an egg is good or bad, hold it up to the light. A good egg is translucent, but a bad one is perfectly opaque; the difference is as easily perceived as that between a blue egg and a white one.

1632. To Preserve by Alcohol. Strong alcoholic liquors are used to prevent decomposition in both vegetable and animal bodies. They penetrate the substances, combine with its juices, and as the organic tissues have less attraction for the spirituous mixture, it escapes; and the tissues themselves shrink and harden in the same way as when salted. Alcohol also obstructs change by seizing upon the oxygen in the atmosphere, in virtue of its superior attraction for that gas, thus preventing it from acting upon the substance to be preserved.

1633. German Soup Tablets. Reinsch gives the following receipt for making the soup tablets so much in use in the German army during the late war: Take 11 parts by weight of good suet, melt it an iron pan, and make it very hot, so as to become brown; add, while keeping the fat stirred, 18 parts rye meal, and continue heating and stirring so as to make the mass brown; add then 4 parts dried salt and 2 parts coarsely pulverized caraway seed. The mixture is then poured into tin pans somewhat like those used for making chocolate into cakes. The cakes have the appearance of chocolate, and are chiefly intended for the use of soldiers while in the field. A quantity of about 1 ounce of this preparation is sufficient to yield, when boiled with some water, a ration of good soup, and, in case of need, the cakes, being agreeable to the taste, may be eaten raw.

1634. To Can Fresh Fruit. Procure a sufficient number of tin cans of suitable size, fill them quite full with the fruit, and solder them securely. Next pierce a small pin-hole in the top of each can, to allow the air to be expelled; place the cans in a boiler as deep as the cans are high, pour boiling water into the boiler until within ½ inch of the top of the cans; keep the water hot over a moderate fire, but not boiling, until the air ceases to escape from the cans, and then seal the air holes with solder before removing the cans from the water. The cans should then be taken out, wiped dry, and allowed to cool; when cold, if the cans have been closed perfectly air-tight, the vacuum inside will cause the top and bottom of the cans to become concave or hollowed inwards. (*See No.* 1611.) Tomatoes are also kept fresh in this manner.

1635. To Insure Success in Canning Fruit. Select fresh fruit that is perfectly ripe; but, at the same time, perfectly sound. One unsound berry may injure all in contact with it.

The *boiling* water poured into the boiler will be considerably cooled by contact with the cans; care must be taken not to let the water return to the boil while the cans are in it; and yet it must become hot enough to expel the air from the cans.

The surest way to attain the desired object is to keep the bulb of a thermometer in the water. A heat of 200° to 208° Fahr. will answer best, but it must never exceed the latter degree. To ascertain when all the air possible has been expelled, put one drop of hot water on the air hole; the cessation or absence of air bubbles passing through it will denote that the cans are ready for final sealing.

1636. To Can Berries. Peaches, apples, pears, plums, &c., can be kept perfectly fresh in tin cans in the manner described in No. 1634, and will retain their fresh flavor almost, if not entirely, intact. Raspberries, strawberries, &c., are kept in better condition by adding ½ pound white sugar to each pound of fruit, letting them come to the boil, and then filling the cans *quite* full, soldering the lid of the can immediately. The hot fruit will, to all intents, expel the air from the can. No water should be used with fruits, except in cases where a little is necessary to dissolve the sugar, as it tends to render them insipid. Most vegetables can be kept in cans in this way, omitting the sugar, and scalding them in water sufficient to cover them.

1637. To Expel the Air from Cans. Air, by heating, expands many times its own bulk; consequently, if you take a jar and cover it tightly with the exception of a hole the size of a pin through the cover, and set it in boiling water, as air expands 20 times its bulk by heating, it is obvious that $\frac{19}{20}$ of the air pases out through the pin hole in the cover; now drop a little sealing wax or solder over the pin hole and you have but $\frac{1}{20}$ of the air in the jar that was in it before heating it. Of course the fruit and syrup, if put into the jar cold, displaces most of the air; but putting it in as hot as it can be, and filling as full as possible, expels the air to all intents and purposes. Cans managed in this way, when made of sheet metal, frequently collapse from outside atmospheric pressure as they cool off, showing that the exhaustion was complete; even more so than needed.

1638. To Keep Fruit Fresh in Jars. Use only self-sealing glass jars. Put into a porcelain-lined preserving kettle, enough to fill 2 quart jars; sprinkle on sugar, ¼ pound; place over a slow fire and heat through, not boiled. While the fruit is being heated, keep the jars filled with moderately hot water. As soon as the fruit is ready, empty the water from the jars, fill to the brim with fruit, and seal immediately. As it cools a vacuum is formed, which prevents bursting. In this way every kind of fruit will retain its flavor. Sometimes a thick leathery mould forms on the top—if so, all the better. The plan of keeping the jars full of hot water is merely to prevent the danger of cracking when the hot fruit is inserted. Some prefer to set the bottles full of cool water in a boiler of water and heating all together gradually; but the other way is much simpler and equally effective.

1639. To Can Peaches by the Cold Process. Pare and halve the peaches. Pack them as closely as possible in a can without any sugar. When the can is full, pour in sufficient pure cold water to fill all the interstices between the peaches, and reach the brim of the can. Let it stand long enough for the water to soak into all the crevices—say six hours—then pour in water to replace what has sunk away. Seal up the can, and all is done. Canned in this way, peaches retain all their freshness and flavor. There will not be enough water in them to render them insipid. If preferred, a cold syrup could be used instead of pure water, but the peaches taste most natural without any sweetening.

1640. To Dry Apples, Pears and other Fruits. Have a frame made in the following manner:—Two strips of board 7 feet long, 2 or 2½ inches wide—two strips 3 feet long, 1½ inches wide, the whole ¾ of an inch thick; nail the long strips across the ends of the short ones, and it makes a frame 7 by 3 feet, which is a convenient size for all purposes. On one of the long strips, nails are driven 3 inches apart, extending from one end to the other. After the apples are pared, they are quartered and cored, and with a needle and twine, or stout thread, strung into lengths long enough to reach twice across the frame; the ends of the twine are then tied together, and the strings hung on the nails across the frame. The apples will soon dry so that the strings can be doubled on the nails, and fresh ones put on, or the whole of them removed and others put in their place. As fast as the apples become sufficiently dry they can be taken from the strings, and the same strings used to dry more on. If large apples are used to dry, they can be cut in smaller pieces. Pears and quinces, and other fruits that can be strung, may be dried in this way. In pleasant weather the frames can be set out of doors against the side of the building, or any other support, and at night, or on cloudy and stormy days, they can be brought into the house, and set against the side of the room near the stove or fire-place.

1641. To Keep Apples and Pears Fresh. Gather the fruit during a dry day, and put it at once into earthen glazed pans, deep enough to contain two or three layers of fruit, and each pan having a tightly-fitting lid. If the fruit sweats, the exudation dries on the fruit's surface, and helps to keep in the moisture and flavor. The cover helps to do the same, and to exclude the light. Keep the pans in a dry, cool place, and never wipe the fruit until required for dessert. Pears may be kept in the same way, but require careful and constant watching.

1642. To Keep Fruit Fresh. After they have been allowed to lay on the shelves in the fruit-room, and sweat, they should be wiped dry, and packed in boxes with dry saw-dust enough to exclude the air from them. The saw-dust from resinous woods should not be used. If they were packed in dry sand, they would keep equally, and perhaps better; but the objection is that it is very difficult to clean them from sand, and therefore they always eat gritty when so kept.

1643. Preservation of Fruit in Glycerine. Glycerine of purest quality has been recommended for the preservation of fruits; previous to eating which, the glycerine should be removed by immersing the fruit in water.

1644. To Restore and Improve Musty Flour. Carbonate of magnesia, 3 parts; flour, 760 parts. Mix and use the flour in the usual way. This will not only greatly improve bad flour, but the bread will be much lighter, more wholesome, and keep longer than when alum is used.

1645. To Keep Game. Newly ground coffee, sprinkled over game, will keep it sweet and fresh for several days. Clean the game; that is, wipe off the blood, cover the wounded parts with absorbent paper, wrap up the heads, and then sprinkle ground coffee over and amongst the feathers or fur, as the case may be; pack up carefully, and the game will be preserved fresh and sweet in the most unfavorable weather. Game sent open and loose, cannot, of course, be treated in this manner; but all game packed in boxes or hampers may be deodorized as described. A tea-spoonful of coffee is enough for a brace of birds; and in this proportion for more or for larger game.

1646. To Preserve with Creosote. Creosote, a pungent compound existing in common smoke, and which starts the tears when the smoke enters the eyes, is a powerful antiseptic, or preventer of putrefaction. It is employed to preserve animal substances, either by washing it over them or by immersing them in its aqueous solution. A few drops in a saucer, or on a piece of spongy paper, if placed in a larder, will effectually drive away insects, and make the meat keep several days longer than otherwise. By all the modes in which creosote has hitherto been employed in preserving meat, it has acquired a disagreeable taste and smell. This may be obviated by placing a small plate containing a little creosote immediately under each piece of meat as it hangs in the larder, and covering them both over with a cloth. A small quantity added to brine or vinegar is commonly employed to impart a smoky flavor to meat and fish, and its solution in acetic acid is used to give the flavor of Scotch whiskey to plain spirit. The preservative effect of smoke-drying is partially due to creosote, which gives to the meat its peculiar smoky taste, and partly to desiccation.

1647. To Test Creosote. A large proportion of ordinary creosote is simply carbolic acid; but the pure creosote, which constitutes the peculiar smell of smoke, is quite a different substance, and may be distinguished from the false by its behavior with collodion. A mixture of this latter with carbolic acid gives a gelatinous precipitate, while with true creosote the collodion remains clear. Dr. Hager gives another test: To a weak solution of iron, a few drops of ammonia are added, until the precipitate which originally forms is dissolved. Carbolic acid communicates a blue or violet tinge to the solution, while genuine creosote gives a green color, afterward turning to brown.

1648. Charcoal as an Antiseptic. It is well known that charcoal possesses extraordinary powers in checking decomposition, as well as in deodorizing animal substances which have already begun to undergo change. Meat, either before or after it is cooked, may be preserved for a considerable time, even in warm weather, by being placed in the centre of a clean earthenware vessel, and closely surrounded with pieces of common charcoal. To prevent the flies from "blowing" the meat, the vessel ought to be covered with wire-gauze. Putrid water is immediately deprived of its bad smell by charcoal. When meat, fish, &c., from intense heat or long keeping, are likely to pass into a state of corruption, a simple mode of keeping them sound and healthful is by putting a few pieces of charcoal, each about the size of an egg, into the pot or saucepan wherein the fish or flesh is to be boiled.

1649. Caution About Charcoal. It must be recollected that in all cases, to exercise its highest powers as a disinfectant, deodorizer, and bleacher, charcoal should be both fresh-burnt and fresh-powdered, and carefully preserved out of contact with the air, until about to be employed. Exposed to the air, it rapidly loses its valuable qualities.

1650. To Prevent Water From Putrefying. Keep it in an iron vessel, or immerse fragments of iron in it. Distilled water should be kept in stoppered glass bottles.

Solutions for Anatomical Preparations.

These antiseptic fluids are used for preserving anatomical preparations, objects of natural history, &c., by immersing them therein, or by injection into the veins and arteries, arresting putrefaction, and preventing decay. Those containing corrosive sublimate (bichloride of mercury) are apt to render animal substances very hard.

1652. Creosote Antiseptic Solution. Nearly saturate water with sulphurous acid, and add a little creosote.

1653. Chloride of Tin Antiseptic Solution. Dissolve 4 parts chloride of tin in 100 parts water containing 3 parts muriatic (hydrochloric) acid.

1654. Antiseptic Solution of Ammonia. Mix 1 part, by weight, strong liquor of ammonia, with 3 parts water and 3 parts rectified spirit. Or:—1 part sal ammoniac and 10 or 11 parts water; for the muscular parts of animals. A solution of 1 part sulphate of zinc in about 20 parts water may also be used for the same purpose.

1655. Babington's Antiseptic Solution. 1 part of wood naphtha to 7 parts water. Wood naphtha undiluted serves for injection.

1656. Burnett's Antiseptic Solution. 1 pound chloride of zinc in 1 gallon water. The substance is immersed in this for 2 to 4 days, and then dried in the air.

1657. Gannal's Antiseptic Mixture. Dissolve ½ pound each alum and table salt, and ¼ pound saltpetre, in 1 gallon water.

1658. Réboulet's Antiseptic. For pathological specimens. Dissolve 1 part nitre (saltpetre), 2 parts alum, and 4 parts chloride of lime in 16 to 20 parts water. To be afterwards diluted according to circumstances.

1659. Thwaites' Fluid. Mix 1 ounce spirit of wine with creosote sufficient to saturate it; rub up with chalk to form a thin paste, and mix gradually with 16 ounces water. To this may be added an equal quantity of water saturated with camphor.

1660. Simple Creosote Solution. Dissolve 1 drachm creosote in 1 drachm pyroligneous acid, and mix gradually with 1 pint cold water.

1661. Passini's Solution. For blood-globules, nerves, and white tissues generally. Chloride of mercury, 1 part; chloride of sodium, 2 parts; glycerine, 13 parts; distilled water, 113 parts.

1662. Preservative Fluids for Microscopic Objects. Canada balsam, spirit and water, glycerine solution of gelatine, saturated solutions of alum, chloride of zinc, and chloride of calcium, are all used to preserve microscopic objects.

1663. Solution for Preserving Feathers. Dissolve 16 grains strychnine in 1 pint rectified spirit.

1664. Corrosive Sublimate Antiseptic Solution. Dissolve 1 part corrosive sublimate (bichloride of mercury), and 3 parts chloride of sodium (table salt), in 100 parts water containing 2 parts muriatic (hydrochloric) acid.

1665. Goadby's Antiseptic Solutions. 2 ounces bay salt, 1 ounce alum, 1 grain bichloride of mercury (corrosive sublimate), and 1 pint of water. This is good for ordinary purposes. But for tender tissues, or where there is a tendency to mouldiness, double the proportions of corrosive sublimate and of water. For subjects containing carbonate of lime, double the proportion of bay salt, and omit the alum.

Or:—¼ pound bay salt, 10 grains arsenious acid, and 1 pint water; adding 1 grain corrosive sublimate when there is any tendency to softening in the parts of the subject. These are excellent antiseptic solutions.

1666. Embalming. Mix together 5 pounds dry sulphate of alumina, 1 quart warm water, and 100 grains arsenious acid. Inject 3 or 4 quarts of this mixture into all the vessels of the human body. This applies as well to all animals, birds, fishes, &c. This process supersedes the old and revolting mode, and has been introduced into the great anatomical schools of Paris.

1667. Preparation for Stuffing Birds and Animals. Camphor, 1 ounce; corrosive sublimate, 1 ounce; alum, ½ ounce; sulphur, 1 ounce; all finely powdered and mixed.

1668. Antiseptic for Preserving Birds and Animals. The simplest means of preserving anatomical and pathological preparations is the use of the following solution: Saturated solution of alum, 100 parts; saltpetre, 2 parts. The article to be preserved is immersed in the solution, when it becomes decolorized; but in a few days the color returns, when it is taken out of the solution, and kept in a saturated solution of alum and water only.

1669. Bécœur's Arsenical Soap. Camphor, 5 drachms; arsenic, 4 ounces; white soap, 4 ounces; carbonate of potash, 12 ounces; air-slaked lime, 4 ounces; make a stiff paste with a little water. Used for preparing the skins of birds and other small animals.

1670. Bécœur's Fluid Arsenical Soap. This is prepared as follows:—Cut 1 pound soap into thin slices, put it with a little water into a pot upon the fire, stirring frequently with a wooden spoon until dissolved; add 6 ounces carbonate of potassa and 2 ounces chalk. Then take it off the fire, and add 1 pound arsenious acid, stirring it in thoroughly; lastly, pound 3 ounces camphor in a mortar with a little alcohol, and incorporate it with the rest of the ingredients. This makes a composition of a consistence of paste. When required for use, dissolve 2 ounces in a pint of alcohol, and apply with a brush.

1671. Laurent's Antiseptic Soap. Place ½ ounce powdered soap in a bottle with 2 drachms each of arsenite of potassa, sulphate of alumina, and pulverized camphor; pour upon them 6 ounces alcohol, and allow them to stand 24 hours. When thoroughly combined, add 3 drops oil of thyme, and cork the bottle carefully.

1672. Beconi's Arsenical Soap. Arsenious acid, 32 ounces; carbonate of potassa, 12 ounces; camphor, 5 ounces; white soap, 32 ounces; powdered lime, 8 ounces. Reduce each to a powder, and mix. Used as a preservative for specimens of natural history against the attacks of insects.

1673. Carbolic Acid as a Preservative. Reference has been made in some of the scientific journals to experiments upon carbolic acid as a means of preserving objects of natural history, and the anticipation has been indulged in by many that this powerful agent may be able to replace all the ordinary methods of taxidermy. This, however, is a very great mistake, since it can be used to a small extent only in the preparation of entire bodies of animals that are to be preserved dry—because the process of desiccation will inevitably proceed until the original form of the animal is entirely lost. For many purposes, however, carbolic acid has proved of much value as a preservative, and its uses are increasing. Thus, diluted with about 50 times its bulk of water, it forms a capital substitute for alcohol in preserving fish and other objects; and, in fact, the larger fish, such as rays, sharks, etc., can be kept much better by its aid than even by means of alcohol. Added in small quantity to very weak spirit, it very materially increases its preservative strength.

1674. Carbolic Acid as a Temporary Preservative. Although carbolic acid cannot be used as a substitute for the usual methods in setting up birds and mammals, it can be employed to very great advantage in keeping them fresh until they can be properly skinned. An experiment of this kind was once made by Dr. Totten, of New York, who prepared a solution of 1 drachm of carbolic acid, 1½ ounces each of glycerine and dilute alcohol, and injected it into the mouth, the rectum, and under the skin of a large cormorant. The bird was kept on board ship until it reached New York, a period of about two months after its capture, and was then sent to a taxidermist, who found it to be in perfect condition, and who was able to mount it as satisfactorily as if it had been but just killed.

1675. Von Vetter's Process for the Preservation of Anatomical Specimens. Add to 7 parts of glycerine at 22° Baumé, 1 part raw brown sugar and ½ part nitre, till a slight deposit is formed at the bottom of the vessel. The portion required to be preserved is then immersed (dried or not dried) and left in the mixture for a time proportional to its dimensions; a hand, for example, should remain eight days in the liquid; when it is taken out it is as stiff as a piece of wood, but if it be suspended in a dry and warm place the muscles and articulation recover their suppleness.

1676. Preserving Insects. A good way to render insects durable is to perforate their bodies once or twice with a long pin dipped in a strong solution of corrosive sublimate. If you have cases full, clean the insects and cases as thoroughly as possible, paint the inside of the cases over with a brush dipped into a solution of the sublimate, and after putting a few pieces of camphor at the bottom of the case, fix the lid on, and paste a strip of paper over the crevices.

To Preserve Wood.

The following receipts for preserving timber from decay have been obtained from various sources, and are the results of careful experiment by scientific experts.

1678. To Prevent the Splitting of Logs and Planks. Logs and planks split at the ends because the exposed surface dries faster than the inside. Saturate muriatic acid with lime, and apply like whitewash to the ends. The chloride of calcium formed attracts moisture from the air and prevents the splitting. Tobacconists' signs, and other wooden images, have usually a hole bored through their centre, from top to bottom; this in a great measure prevents the outer surface from cracking, by allowing the wood to dry and shrink more uniformly.

1679. To Preserve Timber from Decay and Dry-Rot. The best way to preserve timber exposed to the action of the weather is to force into the pores of well-seasoned wood as much carbolic acid, or creosote, as possible. This soon resinifies, and most effectually prevents the timber from dry-rot and decay. On a large scale, as for railway sleepers, expensive appliances are needed; but for barns or outbuildings it may be applied to considerable advantage by the use of a paint brush.

1680. Solution to Preserve Wood. With every 25 gallons of water required, mix 5 pounds chloride of zinc. Wood steeped in this solution will effectually resist dry-rot.

1681. To Kyanize Wood or Cordage. Immerse the wood or cordage in a solution of 50 or 60 parts water and 1 part corrosive sublimate. This preserves it from decay, and renders wood tough and more difficult to split.

1682. To Preserve and Harden Wood. Wood steeped in a solution of copperas becomes harder and more indestructible.

1683. German Receipt for Coating Wood with a Substance as Hard as Stone. Melt together 40 parts chalk, 50 resin, and 4 linseed oil; to this should be added 1 part oxide of copper, and afterwards 1 part sulphuric acid. This last ingredient must be added carefully. The mixture, while hot, is applied with a brush, and forms, when dry, a varnish as hard as stone. This is an excellent application to protect posts, tubs, or other wooden articles which are set in the earth.

1684. To Preserve Wood Under Water. Wood impregnated with creosote oil has been found to resist effectually the ravages of the teredo worm; this worm being the cause of decay by honey-combing the entire substance of the wood. In Germany chloride of zinc is used for this purpose, the timber being placed in boilers, partly exhausted of air, and the vapor of chlorine thus driven into it. These remedies are recommended by a committee of practical experts, appointed by the Academy of Sciences in Holland to ascertain the best means for preserving timber under water.

1685. Preservation of Wood. Armand Muller has instituted some interesting experiments upon this subject, and arrives at the conclusion that the phosphate of baryta, formed by the mutual decomposition of phosphate of soda and chloride of barium, in the pores of the wood, is one of the best preservative agents available to chemists. Soak the wood 5 days in a 7 per cent. solution of phosphate of soda, and after drying, suspend in a 13 per cent solution of chloride of barium for 7 days. It is believed that wood thus prepared will withstand the action of moisture better than with any other preparation. The chief obstacle to the use of such chemicals is in their cost.

1686. To Petrify Wooden Objects. Take equal quantities of gem-salt, rock-alum, white vinegar, chalk and pebbles, powdered. Mix all these ingredients; ebullition will ensue. After it has ceased, throw some wooden objects into this liquid, and let them soak for 4 or 5 days, at the end of which time they will be transformed into petrifactions.

Mixtures for Freezing without Ice. In the following table, the water should not be warmer than 50° Fahrenheit.

Mixtures.		Fahrenheit Thermometer Sinks from	Degrees of Cold Produced
Nitrate of Ammonia, 1	part.	50° to 4°	46°
Water 1	"		
Muriate of Ammonia 5	"	50° to 10°	40°
Nitrate of Potash 5	"		
Water 16	"		
Muriate of Ammonia 5	"	50° to 4°	46°
Nitrate of Potash 5	"		
Sulphate of Soda 8	"		
Water 16	"		
Sulphate of Soda 3	"	50° to —3°	53°
Diluted Nitric Acid 2	"		
Nitrate of Ammonia 1	"	50° to —7°	57°
Carbonate of Soda 1	"		
Water 1	"		
Phosphate of Soda 9	"	50° to —12°	62°
Dilute Nitric Acid 4	"		
Sulphate of Soda 8	"	50° to 0°	50°
Hydrochloric Acid 5	"		
Sulphate of Soda 5	"	50° to 3°	47°
Diluted Sulphuric Acid, 4	"		
Sulphate of Soda 6	"	50° to —10°	60°
Muriate of Ammonia 4	"		
Nitrate of Potash 2	"		
Diluted Nitric Acid 4	"		
Sulphate of Soda 6	"	50° to —14°	64°
Nitrate of Ammonia 5	"		
Diluted Nitric Acid 4	"		

1688. Table of Freezing Mixtures with Snow.

Mixtures.		Fahrenheit Thermometer Sinks from	Degrees of Cold Produced
Snow 3	parts.	32° to —23°	55°
Diluted Sulphuric Acid, 2	"		
Snow 8	"	32° to —27°	59°
Muriatic Acid 5	"		
Snow 7	"	32° to —30°	62°
Dilute Nitric Acid 4	"		
Snow 4	"	32° to —40°	72°
Muriate of Lime 5	"		
Snow 2	"	32° to —50°	82°
Crys'd Muriate of Lime, 3	"		
Snow 3	"	32° to —51°	83°
Potash 4	"		

1689. Freezing Mixtures with Pounded Ice or Snow. The following mixtures reduce the temperature down to a certain degree of cold, irrespective of the temperature of the materials at mixing.

Mixtures.		Fahr. Thermometer Sinks.
Snow, or Pounded Ice 2	parts.	to —5°
Muriate of Soda 1	"	
Snow, or Pounded Ice 5	"	to —12°
Muriate of Soda 2	"	
Muriate of Ammonia 1	"	
Snow, or Pounded Ice, 24	"	to —18°
Muriate of Soda 10	"	
Muriate of Ammonia 5	"	
Nitrate of Potash 5	"	
Snow, or Pounded Ice 12	"	to —25°
Muriate of Soda 5	"	
Nitrate of Ammonia 5	"	
Snow, or Pounded Ice 2	"	to —4°
Common Table Salt, or Rock Salt 1	"	

1690. Metallic Freezing Mixture. An interesting experiment may be made by melting together 59 parts tin, 103½ lead, and 183 bismuth. If this be finely rasped or powdered, and introduced into 108 parts, by weight, of quicksilver, a thermometer immersed in the mixture will sink to nearly 3° Fahr.; and water placed in a thin test-tube, and allowed to remain for a few minutes in this bath, will be completely frozen.

1691. How to Keep Ice in Summer. No refrigerator or ice-box will prevent, or even retard the melting of the ice, which does not combine the following conditions: It must have double sides, bottom, and lid, with the space between the two casings filled with some non-conducting substance, in order to exclude the external temperature; and the inner lid or cover should be practically, if not hermetically, air-tight, in furtherance of the same result. If external air enters, it will bring its own temperature with it. There should be also a drainage-pipe at the bottom to carry off, instantaneously, every drop of water formed by the melting of the ice, and this pipe should either be fitted with a trap or curved in such a manner as to prevent the cold air from escaping. It is even more indispensable to carry off every drop of the water than it is to exclude the air—a view not generally entertained by consumers of the article, but which, according to experiments made, seems to be fully demonstrated. Thus, on exposing a piece of ice weighing, say 25 pounds, to the air, at a temperature of 75°, but so placed that it is perfectly drained, it will be found to have scarcely disappeared at the end of 24 hours. Wrap the same piece in 3 or 4 thicknesses of blanket or flannel, and place it in a small tub exposed to the same temperature, and as the water filters through the blanket, the ice will stand in its own water, and will be all dissolved in 5 or 6 hours. Wrap the same piece of ice carefully in a blanket, and place it on a grating, or on four crossed sticks, so that no water can accumulate underneath, and at the end of 3 or even 4 days it will not have entirely melted.

Disinfectants are substances which absorb, neutralize or destroy putrescent effluvia and miasmata, and thus remove the causes of infection. The principal disinfectants are chlorine, the chlorides (hypochlorites) of lime and soda, chloride of zinc, charcoal, carbolic acid, the fumes of nitric, nitrous, and sulphurous acids, and ventilation. The clothing, bedding, &c., of patients laboring under contagious diseases, may be effectually disinfected by exposing to a temperature of about that of boiling water. Neither the texture nor color of textile fabrics is injured even by a heat of 250° Fahr. It is a practice at some of the poorhouses to bake the clothes of the paupers who have the itch, or are infested with vermin. Quicklime rapidly absorbs carbonic acid, sulphuretted hydrogen, and several other noxious gases, and is therefore commonly used as a wash for the walls of buildings. Acetic acid, camphor, fragrant pastils, cascarilla, and other similar substances, are frequently burnt or volatilized by heat, for the purpose of disguising unpleasant odors. The chlorides as well as the sulphates of iron and lime have the property of rapidly destroying noxious effluvia. A quantity of either of these sulphates thrown into a cesspool, for instance, will in a few hours remove the fetid smell.

1693. Metropolitan Disinfecting Fluid. The Board of Health of the city of New York have recommended a disinfecting fluid composed of sesquichloride of iron, chloride of manganese, chlorine, and carbolic acid. The sesquichloride of iron has been found by experiment to deodorize more effectually than chloride of lime, sulphate of zinc, or other disinfectants. It is therefore recommended as an important constituent of any disinfectant. Sesquichloride of iron is prepared by dissolving the hydrated sesquioxide of iron in muriatic acid; to this is added 10 per cent. of carbolic acid. This forms the fluid in a concentrated form, and is largely diluted with water at the time of using. All night scavengers are compelled by the Board of Health of New York to use it. Its effects are compound. The iron checks fermentation, and the chlorine acts as an oxidizing agent. Its carbolic acid also aids in arresting decomposition and fermentation, and the whole combination, therefore, by its chemical action, decomposes the sulphuretted hydrogen.

1694. To Disinfect Stables and Slaughter-Houses. Dr. Letherby, Health officer of the city of London, says in a recent report on the subject, that the best disinfectant for stables and slaughter-houses is a mixed chloride and hypochlorite of zinc, and it has the advantage of mixing freely with the liquid matters of the slaughter-house, and not tainting the meat with any unpleasant odors; and it is also applicable to the disinfection of houses in place of chloride of lime, which it much resembles in its chemical nature and mode of action.

1695. Burnett's Disinfecting Fluid. A solution of chloride of zinc, made by dissolving zinc in commercial muriatic acid to saturation, and known as Sir William Burnett's Disinfecting Fluid, has been found most useful as a purifying agent, and in removing and destroying contagion. In purifying sick rooms or crowded places the solution should be moistened by means of a piece of flannel cloth, about 3 or 4 feet square, attached to a long rod and waved through the air for 10 minutes at a time; in addition to which the floor should be mopped or sprinkled over with the same dilute solution, if necessary, several times a day, and a small quantity put into the close-stools and bed-pans. The water-closets should also be cleansed with it, and 2 gallons occasionally thrown down each. When floors and woodwork are washed with the solution, the use of soap or soda should be avoided immediately before or after its application; and whitewashing should not be applied to any part recently washed or sprinkled with it.

1696. To Purify a Sick Chamber. The nitrous acid vapor, so invaluable as a disinfectant in contagious fevers, is obtained by decomposing nitre by means of heated sulphuric acid, in the following manner: Put ½ ounce sulphuric acid in a crucible glass or china cup and warm it over a lamp or in heated sand, adding to it from time to time a little nitre. Several of these vessels must be placed in the sick chamber and in the neighboring apartments and passages, at a distance of 20 feet or more from each other, according to the height of the ceiling and the virulence of the contagion. As an evidence of the value of this method of disinfection it may be mentioned that Dr. Carmichael Smyth, of London, by whom it was originally practiced, received from Parliament a premium of £5,000 for his discovery.

1697. Hyponitrous Acid as a Disinfectant. A special commission was appointed by the Academy of Sciences at Paris, to study the different means of disinfecting those localities which, during the siege, had been appropriated to persons afflicted with contagious diseases. Its report furnishes some useful guides to the selection and the application of disinfectants. It was agreed that the very first place among destructive agents which can attack and destroy infectious germs, should be assigned to hyponitrous acid. Great precaution should be exercised, however, by those employing the very dangerous nitrous vapors.

1698. Carbolic Acid as a Disinfectant. The French commission (*see No.* 1697) also reported that carbolic acid is much more easily applied, is less dangerous and expensive than hyponitrous acid, and seems to offer guarantees of quite equal efficacy, founded on experimental evidence. It is best employed by mixing with sand or sawdust in the proportion of 1 part by weight of acid, and 3 parts of the inert material. The mixture is placed in earthen pots. Carbolic acid, diluted with 25 to 30 times its weight of water, has been found useful in sprinkling daily the floors and the bedding of sick chambers. It has been stated by M. Devergie, that water containing only the $\frac{1}{4000}$ part of its weight of carbolic acid sufficed for the disinfection of a dead-house during the hottest weather, when it contained from 6 to 7 bodies.

1699. Collins' Disinfecting Powder. Mix 2 parts dry chloride of lime with 1 of burnt alum. To be set in shallow dishes in rooms, &c., with or without the addition of water.

1700. Ellerman's Deodorizing Fluid. This consists chiefly of perchlorides and chlorides of iron and manganese. In a report addressed to the Metropolitan Board of Works of London in 1859, Drs. Hoffman and Frankland stated that the perchloride of iron was the cheapest and most efficient deodorizer that could be applied to sewage; ½ gallon deodorized 7500 gallons. 1 bushel lime, or 3 pounds chloride of lime, would do the same.

1701. Condy's Solution. A saturated solution of permanganate of potassa is one of the most efficient and elegant of all disinfectants. A tea-spoonful in a soup-plate of water, exposed in a room, quickly removes any offensive smell; when the pink color disappears more must be added. It has been used to remove the smell of bilge-water and guano from ships. A word as to economy: One ounce of the crystallized salt costs about as much as a pound of the crude, which is just as good for deodorizing purposes. The crude gives a greenish solution, which, even while cold, but more rapidly and completely upon boiling, passes into the deep red so characteristic of the permanganate, and is fit for use. It speedily cleanses foul water and makes it drinkable. A tea-spoonful to a hogshead is generally enough, but if added until the water acquires a permanent faint tinge, we are certain that injurious organic matter has been destroyed. Then, as Condy suggests, if a piece of clean stick be put into the liquid, or if a little tea or coffee be added, the pink color will disappear, and the water will be fit for use. The very small amount of potassa remaining in the solution could not possibly do any harm, as it would not amount to $\frac{1}{10}$ part of a grain to the gallon.

1702. Siret's Compound. Sulphate of iron, 20 pounds; sulphate of zinc, 3½ pounds; wood or peat charcoal, 1 pound; sulphate of lime, 26½ pounds; mix and form into balls. To be placed in cesspools, &c., to deodorize them. M. Siret has subsequently modified this compound thus: Sulphate of iron, 100 parts; sulphate of zinc, 50; tan or oak-bark powder, 40; tar, 5; and oil, 5 parts.

1703. Ledoyen's Solution. This is a solution of nitrate of lead, and contains about 20 ounces of the salt in a gallon. The specific gravity should be 1.40. A similar compound may be made by mixing 13½ ounces litharge with 6 pints water, and adding 12 ounces nitric acid at 1.38 specific gravity (or 8 ounces at 1.50) and digesting at a gentle heat till the solution is complete.

1704. Chloride of Lime as a Disinfectant. It is a great purifier. 1 pound requires 3 gallons of water; use the clear solution. To purify rooms, sprinkle on the floor, and, if needful, on the bed-linen. Infected clothes should be dipped in it and wrung out, just before they are washed. It purifies night commodes, water-closets, &c. It may also be used in its pure state. For butcher stalls, fish markets, slaughter houses, sinks, and wherever there are offensive putrid gases, sprinkle it about, and in a few days the smell will pass away. If a cat, rat, or mouse, dies about the house, and sends forth an offensive gas, place some chloride of lime in an open vessel near the place where the nuisance is, and it will soon purify the atmosphere. The presence of chloride of lime in a room causes iron or steel to rust rapidly. Articles of that material should therefore be removed during the use of this disinfectant.

1705. Precautions to be Observed Before Entering a Sick Room, particularly where there is Fever.

Never enter fasting; if it is inconvenient to take refreshment of the ordinary kind, obtain a glass of wine and a cracker.

Do not stand between the patient and the door, if possible. Avoid sitting on or touching the bed-clothes as much as possible, and do not inhale the patient's breath. The hands should always be washed in clean water, if the patient has fever, before leaving the room to touch other people or things.

After visiting a fever patient, &c., change the dress, if possible. As soon as the fever is over, and the patient is convalescent, the dress which has been used by the nurse or attendant should be destroyed if there are no means of fumigation at hand, or it must be boiled in water to which carbolic acid has been added. The same treatment must be applied to the bed-clothes, &c., which have been used.

1706. Onions as a Disinfectant. Onions placed in the room where there is small-pox will blister, and decompose with great rapidity; besides this, they will prevent the spread of the disease. As a disinfectant they have no equal, when properly used; but keep them out of the stomach.

1707. To Prevent Infection. Let communication with the sick by actual contact be as far as possible avoided. Let the patient be lightly covered with the bed-clothes, his chamber freed from all unnecessary articles of furniture, and kept perfectly clean; the sheets and body linens frequently changed and removed from the sick room, as well as all substances producing, or likely to produce, any smell; and above all things let the chamber and the adjoining apartments and passages be completely and freely ventilated by opening opposite doors and windows; for although contagion may be carried by the air, it becomes inert when, instead of being concentrated, it is sufficiently diffused.

1708. Special Preservative Against Infection. In a lecture delivered in the Royal Institution, Professor Tyndall proved, by a series of interesting experiments, that the surest filter in a contagious atmosphere is cotton wool. "If a physician," said the Professor, "wishes to hold back from the lungs of his patient, or from his own, the germs by which contagious disease is said to be propagated, he will employ a cotton wool respirator. In the crowded dwellings of the London poor, where the isolation of the sick is difficult, if not impossible, the noxious air around the patient may by this simple means be restored to practical purity. Thus filtered, attendants may breathe the air unharmed, for it is exceedingly probable that the germs which lodge in the air-passages, and which, at their leisure, can work their way across the mucous membrane, are those which sow in the body epidemic disease. If this be so, such disease may be warded off by filters of cotton wool."

1709. To Diffuse a Fragrant Odor. A few drops of oil of sandal wood dropped on a hot shovel, will diffuse a most agreeable balsamic perfume through the room.

1710. Simple Mode of Purifying Water. A table-spoonful of pulverized alum sprinkled into a hogshead of water (the water stirred at the same time) will, after a few hours, by precipitating to the bottom the impure particles, so purify it that it will be found to possess nearly all the freshness and clearness of the finest spring-water. A pailful, containing 4 gallons, may be purified by a single tea-spoonful of the alum.

1711. To Test the Impurity of the Atmosphere. A simple method of ascertaining the presence of impurity (carbonic acid) in the atmosphere, is to nearly fill a glass tumbler with lime-water, and to place it in any convenient position, as on the mantel-piece of a room. The rapidity with which a pellicle forms on its surface, or the water becomes cloudy, corresponds to the amount of the carbonic acid present in the atmosphere that surrounds it. A little moist carbonate of lead put on a plate or saucer, and exposed in the same way, will turn black, should any sulphuretted hydrogen be contained in the air. This is a delicate test for that destructive gas.

1712. To Purify Water in a Cistern. 2 ounces of permanganate of potassa thrown in a cistern will render the foulest water sweet and pure. (*See No.* 1701.)

1713. To Purify Dirty Water. Since, in dry seasons, any water may be of high value, at least for cattle drinking, M. Meunier advises to place, in a large-sized cask, a false bottom perforated with some holes; and to put on that bottom, first, clean pebbles, next, well washed sand, then a layer of coarsely granulated charcoal, and over all this a piece of canvas. The water, even that standing in shallow ditches after a shower of rain, may be poured into this filter, and thus become available for cattle-drinking, though it may not be quite clear.

Bleaching.

Under this head are included general receipts for bleaching and decolorizing. The methods employed for special purposes, such as bleaching fabrics for dyeing, removing stains, &c., will be found in their proper places by reference to the index.

1715. To Bleach Cotton Pure White. Boil for 3 hours in water containing 1 gill to the gallon of either caustic potassa or caustic soda; wash well from the lye, then lay the yarn or fabric to steep for 4 or 5 hours in cold water containing 1 pint of bleaching liquor (*see No.* 104) to the gallon; then lift out and steep for an hour in a sour of 1 wine-glassful of sulphuric acid to the gallon of water; lift, and wash well; then boil for 2 hours in a caustic lye, half the strength of the first; wash from this, and steep again for 4 hours in the bleaching liquor; wash from this and steep again for 1 hour in a clean sour, made in the same manner as the first; wash well from this, and dry. A little smalt blue is put into the last washing water to clear the white.

1716. To Bleach Wool. The first kind of bleaching to which wool is subjected, is to free it from grease. This operation is called scouring. In manufactories, it is generally performed by an ammoniacal lye, formed of 5 measures of river water and 1 of stale urine; the wool is immersed for about 20 minutes in a bath of this mixture heated to about 130° Fahr; it is then taken out, suffered to drain, and rinsed in running water. This manipulation softens the wool, and gives it the first degree of whiteness. It is then repeated a second, and even a third time; after which the wool is fit to be employed. In some places, scouring is performed with water slightly impregnated with soap; and indeed, for valuable articles, this process is preferable; but it is too expensive for articles of less value. Bisulphide of carbon and benzine have been employed in cleansing wool. The fat may be saved by distilling off the solvent, which may be used over and over again. (*See No.* 439.) Sulphurous acid gas unites very easily with water; and in this combination it may be employed for bleaching wool and silk.

1717. Sulphuration. The process by which silk, cotton, woolen, and straw goods,

&c., are bleached or decolored by exposure to the fumes of burning sulphur. This is effected in a close chamber of a size proportioned to the scale on which the operation is conducted, and supplied with only just sufficient air to keep up the slow combustion of the sulphur, the fumes of which are sulphurous acid. (*See Nos.* 360 *and* 364.)

1718. To Prepare Sulphurous Acid for Bleaching. Sulphurous acid is used either as gas or in solution in water, which dissolves 50 times its volume of the gas. In the former case sulphur is burned in a close room in which the stuffs (moistened) are hung; for small articles a barrel with a lid answers well. 2 exposures, of 24 hours each, suffice for wool. (*See No.* 360.) To get a solution of sulphurous acid, the cheapest and best plan is to heat in a glass retort 12 ounces sulphuric acid and 2 ounces sulphur. The gas, which comes off quietly, is collected in a large glass bottle partially filled with water; or, better, a series of bottles so connected together that the gas must pass successively through the water contained in each.

1719. A New Wash for Wool and Silk. Instead of using the fumes of sulphur, M. Frezon proposes the following mixture: 4 pounds oxalic acid, 4 pounds table salt, 200 quarts water. The goods are laid in this mixture for an hour. They are then generally well bleached, and only require to be thoroughly rinsed and washed. For bleaching straw it is best to soak the goods in caustic soda and afterwards to make use of chloride of lime or Javelle water. (*See Index.*) The excess of chlorine is afterwards to be removed by hyposulphite of soda, called antichlor.

1720. To Bleach Straw Bonnets. Get a deep box, air-tight, if possible; place at the bottom a stone, on the stone a flat piece of iron red hot, or a pan of charcoal, on which scatter powdered brimstone; close the lid, and let the bonnet remain a night. There should be hooks on the box, on which to hang the bonnets. (*See last receipt.*)

1721. To Bleach Sponge. Sponge may be bleached almost snow-white by repetitions of the following process: Soak it in diluted muriatic acid 10 or 12 hours, then wash it with water and immerse in a solution of hyposulphate of soda to which a small quantity of diluted muriatic acid has been added. Wash and dry it.

1722. Blanched Sponge. Soak the sponges for several days in cold water, renewing the water and squeezing the sponges occasionally. Then wash them in warm water, and place them in cold water to which a little muriatic acid has been added. Next day take them out and wash them thoroughly in soft water; then immerse them in an aqueous sulphurous acid (specific gravity 1.034) for a week. They are afterwards washed in plenty of water, squeezed, and allowed to dry in the air.

1723. To Bleach Lac. Dissolve the lac in a boiling lye of pearlash or caustic potash, filter it and pass chlorine through the solution until all the lac is precipitated. Collect the precipitate, wash well in hot water, and finally twist into sticks, and throw them into cold water to harden. Lac thus purified is used to make pale varnishes and the more delicate tints of colored sealing-wax. Shellac bleached by this method is liable to stain furniture inlaid with brass. The following process is free from this objection, and has the additional advantage of being much cheaper:

1724. To Bleach Shellac with Animal Charcoal Any quantity of yellow shellac, previously broken in small pieces, is conveyed into a flask, alcohol of .830 specific gravity poured upon it, and the whole heated on a stove, or, in the summer, in the sun, until the shellac is dissolved; upon this so much coarsely powdered animal charcoal is added to the solution that the whole forms a thin paste; the flask is closed, not quite air-tight, and left so for some time exposed to the sun; and in 8 to 14 days a small sample is filtered, sufficient to ascertain whether it has acquired a light yellowish brown color, and whether it yields a clear, pure polish, on light colored woods. If this be the case, it is filtered through coarse blotting paper, for which purpose it is best to employ a tin funnel with double sides, similar to those employed in filtering spirituous solutions of soaps, opodeldoc, &c. The portion which first passes through the filter may be preserved separately, and used as a ground or first polish. Then some more spirit is poured over the charcoal upon the filter, and the solution used as a last coating. The solution of shellac purified by animal charcoal has a brown yellow color, but it is perfectly clear and transparent; when diluted with alcohol, the color is so slight that it may be used in this state for polishing perfectly white wood, such as maple, pine, &c., without the wood acquiring the least tint of yellow.

1725. To Bleach Gutta Percha. Dissolve 1 part gutta percha in 20 parts hot benzole, shake the solution with $\frac{1}{10}$ part freshly calcined plaster, and set aside, with occasional agitation, for 2 days. The clear pale brownish-yellow liquid is then decanted into another vessel containing double its bulk of alcohol fortius (*see No.* 1439), when the gutta percha will be precipitated in the form of a brilliantly white tenacious mass, which is pounded together in a mortar, and rolled into cylindrical sticks.

1726. Bleaching Woolen Rags. These are most effectually bleached by the application of sulphurous acid. Of course, in many instances, the color of the rags, supposing the same to be dyed or printed goods, will be also destroyed. Chlorine cannot be used for this purpose, because it causes woolen and silk fabrics to become yellow, and impairs the strength of the fibre, by entering into chemical combination with the wool, silk, and other similar substances of animal origin; as, for instance, sponge, animal gut, isinglass, &c., all of which, if requiring bleaching, are bleached by sulphurous acid.

1727. New Method of Bleaching Feathers. This process is an entirely newly-discovered one, whereby the feathers of ostriches and other birds may be bleached, even if these feathers are naturally black or dark gray colored. The feathers are placed for from 3 to 4 hours in a tepid dilute solution of bichromate of potassa, to which, cautiously, some nitric acid has been added. After this lapse of time the feathers will be found to have assumed a greenish hue, owing to the oxide of chromium precipitated on the substance; in order to remove this, the feathers are placed in a dilute solution of sulphurous acid in water, whereby the feathers become perfectly white and bleached. Care is to be taken that the solution of bichromate be not made too strong, and especially that not too much nitric acid be used, which would cause an irremovable yellow color.

1728. Table Showing the Number of Parts of a Weak Bleaching Liquor, Required to be added to 1 Part Bleaching Liquor of 6° Twaddell, to Produce a Liquor of a given Strength. According to Mr. Crum, the strength of liquor for bleaching cotton should be less than 1° Twaddell; the following table enables an operator to increase the strength of a weak bleaching liquor with a great degree of accuracy. The left hand column gives the strength of the weak liquor, expressed in $\frac{1}{12}$ parts of 1°. At the head of the other columns stands the degree of strength required, and under these headings will be found the number of parts of weak liquor required to be added to 1 part of a liquor of 6° Twaddell, to produce the required strength of the mixture. (*See No.* 68.)

Strength of Sample.	Strength Required.			
	$\frac{8}{12}^{\circ}$	$\frac{6}{12}^{\circ}$	$\frac{4}{12}^{\circ}$	$\frac{3}{12}^{\circ}$
Water.	8 parts	11 parts	17 parts	23 parts
$\frac{1}{12}^{\circ}$	9¼ "	13½ "	23 "	35 "
$\frac{2}{12}$	11 "	17 "	35 "	71 "
$\frac{3}{12}$	13½ "	23 "	71 "	
$\frac{4}{12}$	17 "	35 "		
$\frac{5}{12}$	23 "	71 "		
$\frac{6}{12}$	35 "			
$\frac{7}{12}$	71 "			

1729. Properties of Charcoal. This article, when fresh, possesses the property of taking lime and other saline matter from syrups and other aqueous solutions, especially organic ones, at the same time that it decolors them. As a decolorizer and deodorizer, animal charcoal (prepared from bones) is vastly superior to vegetable charcoal. Charcoal should be fresh burnt and fresh powdered and preserved from contact with the air. Unless these precautions be observed it rapidly loses its valuable qualities. (*See No.* 1752.)

1730. Aluminized Charcoal. This is recommended by Dr. Stenhouse as a cheap and very efficient decolorizing agent. Dissolve in water 54 parts of the sulphate of alumina of commerce, and mix with 92¼ parts finely powdered wood charcoal. When the charcoal is saturated, evaporate to dryness, and heat to redness in covered Hessian crucibles till the water and acid are dissipated. The charcoal contains just 7½ per cent. of anhydrous alumina.

1731. Charcoal from Coal-Tar. Heat gently in an iron pot till it melts, 1 pound coal-tar pitch. Add 2 pounds fluid coal-tar, and mix. Stir in 7 pounds hydrate of lime in very fine powder. The thick mass is now roasted, stirring all the time till it is reduced to a fine powder. It is then ignited in a covered crucible till all the vegetable matter is carbonized. The charcoal, when cold, is digested with dilute hydrochloric acid, and finally washed with water in a filter, and dried. Dr. Stenhouse recommends this as an admirable form for decolorization. For such liquids as decoction of logwood it is four times as efficient as animal charcoal.

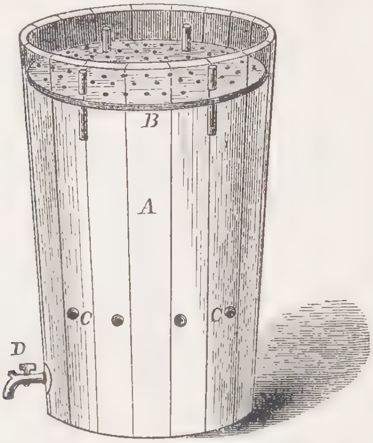
Vinegar.

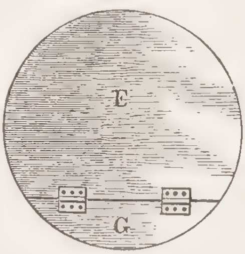
Vinegar is dilute acetic acid more or less mixed with gum, sugar, and other vegetable matter. It can be made from any liquid which is susceptible of the vinous fermentation. In this country it is made chiefly from cider and alcoholic liquors; in England, from malt liquors and molasses; in wine growing countries, from inferior or damaged wine. The cultivation of the vine is gradually gaining importance in this country, and it seems more than probable that, at no distant time, vinegar will be made here largely from wine.

1733. To Make Vinegar by the German, or Quick Method. Many methods have been invented to produce vinegar; but that known as the "German, or quick method," has superseded all others, and is now in general use in the United States. By this process (which is very simple) time and labor are both greatly abridged, and a very fine article is produced. The method will be found embodied in the five following receipts:

1734. How to Make a Vinegar Generator. The construction of a vinegar generator is very simple. A is a tub, 8 feet in height, 3 feet in diameter at the bottom, and 3½ feet in diameter at the top, with a cover, E, of which one part, G, is movable, in order to permit the liquid to be poured in when necessary. B is a shelf or false bottom perforated with a number of holes $\frac{1}{6}$ of an inch in diameter, placed about 8 inches from the top of the generator, at which place a stout hoop must be nailed to support it. When this false bottom is placed in the generator, it should be packed carefully on the sides with cotton batting, so as to prevent the liquid from escaping at any place except through the holes. The shelf or false bottom has also four ½ inch holes, in which are inserted 4 open reed tubes as air vents, each having its ends projecting above and below the shelf, the upper ends projecting at least 1½ inches below the top cover, E, and the other ends penetrating the contents of the generator. C C is a horizontal row of holes at about 18 inches from the bottom of the generator, equidistant, and ½ an inch in diameter, bored in about every other stave, and in a vertical or slanting direction from the outside downward inside. There is also a hole for the insertion of the thermometer, 6 inches below the false top; this hole should slant from the outside, downward inside. The holes are bored in this manner to prevent the vinegar from running out. It is essential to the success of the process that a current of air should pass through the tub.

In order to establish this circulation, the above holes are made, and the air enters by them, and passes out through the tubes in the false bottom above. Some parties insert a perforated false bottom about 2 inches below the slanting ventilation-holes, to support the shavings, leaving the portion of the tub below free; others prefer a similar false bottom about 2 inches above the holes, in order to prevent the shavings from coming in contact with the holes and obstructing the ventilation. D is a stop-cock, or faucet, 6 inches from the bottom of the generator, the discharging capacity of which must be controlled by the size of the generator. Never draw off the vinegar below this faucet.





1735. How to Pack a Vinegar Generator. Having made the generator, the next part of the process of making vinegar consists in packing or charging it; this is done in the following manner: Take pieces of beech board about 18 inches in length (maple or basswood boards will do, but not as well as beech), and plane thick, heavy shavings from the edge; the shavings should curl and roll up, or they must be rolled up and tied. Next cut clean corn-cobs into pieces 1½ or 2 inches long. The shavings and corn-cobs must be thoroughly soaked in water; or, what is still better, boiled in vinegar. Fill the tub half full with the corn-cobs, and let the cobs remain in the tub just as they are thrown there, without further arrangement. Then fill up the balance of the generator with the beech shavings and arrange them so that those which touch the upper false bottom are more strongly pressed than the rest, as the degree of pressure should increase as you pack from the bottom to the top of the generator. The generator being filled, the false bottom must be fitted in and rest level upon the shavings, and great care must be taken not to have the air-tubes stopped up, or the cobs packed too solid in the vicinity of the slanting holes. The shavings or cobs may be loosened at the thermometer and ventilating-holes, by means of a stick thrust therein. The generator may also be entirely packed with beech shavings or entirely with cobs; the latter, however, are inferior, as they soon rot and become worthless. Beech chips are preferred to shavings by some vinegar manufacturers.

1736. Mode of Acetifying Shavings. The next step in the process of manufacturing vinegar consists in acetifying the shavings and cobs; and this is accomplished in the following manner: Preserve a temperature of between 75° and 85° Fahr., and pour over the shavings and cobs, every hour, a mixture of 2 gallons vinegar and ¼ gallon common whiskey (this liquid should first be heated, to hasten fermentation), until there are 10 gallons in the generator above the faucet, but not more. Muspratt recommends a *standard liquor*, both for the acetification of the shavings and for generating of vinegar. It consists of 50 gallons 60 per cent. whiskey, and 37 gallons beer or malt wort. A mixture of 5 gallons of the above mixtures with 40 or 50 of weak vinegar, acetifies still quicker than the standard mixture used alone. Draw off from the generator every hour 2 gallons, and add it again at the top; continue this until the fermentation commences; this usually begins at the top of the generator in the course of 4 or 5 days. The contact of the air with the minutely divided liquid promotes the acetification, which consists essentially in the oxidation of the alcohol. As the oxygen is absorbed, the temperature of the liquor rises to 100° or 105°, and when the thermometer indicates that temperature when placed through the opening in the cover, the generator is ready, and in proper condition for the manufacturer. Pay special attention to the fermentation, for that is the principal point to be observed. It is scarcely necessary to say that the vinegar used for acetifying the shavings should be pure, or at all events free from the mineral acids. It is well known that essential oils, or a mere trace of wood-vinegar, arrest acetification; consequently the vinegar must also be free from pyroligneous acid. After the acetification occurs, proceed as follows:

1737. Mode of Manufacturing Vinegar. Keep the vinegar room at a temperature of from 75° to 85° Fahr., and maintain the temperature of the generators at 95° to 100°. Then make up a mixture or wash composed of the following ingredients: 3 gallons common whiskey; 4 gallons manufactured vinegar; 33 gallons pure water. Muspratt uses 15 or 20 gallons of his *standard liquor* (*see last receipt*), diluted with 60 gallons soft water. The water, if not clear, must be filtered through charcoal. Draw off every hour 4 gallons of vinegar from each generator, and pour in at the top 4 gallons of the above wash, with an additional quart for waste in manufacturing; and pour the vinegar into another generator as soon as it is drawn. Vinegar is thus made by being passed only once or twice through the shavings, according to the quality and degree of strength required. Keep a large tank to hold the vinegar when made, and put ½ gallon of molasses into it every day until you get a bed 2 or 3 inches thick. The molasses will improve the vinegar and give it a fine color. This is the quickest process which has yet been obtained for manufacturing large quantities, and the vinegar made in this way finds ready sale.

1738. Useful Hints to Those Making Vinegar by the Quick Method. The success of the whole process of making vinegar by the German, or quick method, depends almost entirely upon the free circulation of air throughout the generator. It sometimes happens that the vinegar, when it comes from the generator, is not perfectly clear and transparent; to remedy this, some manufacturers use two false bottoms to each generator, and have a bed of white sand, 15 inches deep, upon the lower one. The sand will have to be packed in before the chips are, as follows: First cover the false bottom with flannel, to prevent the sand from coming through the holes, then put in a layer of sand 5 inches deep, cover this with two thicknesses of flannel, and then another layer of sand; repeat this again, and then pack in the chips as already directed. This will produce an article of a fine color, and will pass for a fine wine-vinegar if colored. Persons who are skeptical about this way of making vinegar may test it at a trifling expense on a small scale by experimenting with a keg arranged on the same principle as the generators. Those who desire to go into the business extensively, can have a series of generators. They may be arranged one above the other, and connected from floor to floor by gutta percha tubes, and thus vinegar may be made by passing once through three generators, instead of two or three times through one generator.

1739. To Make Vinegar Quickly. Take a cask or hogshead with the head out, and a faucet near the bottom; fill it with beech shavings prepared as in No. 1735; or, instead of shavings, the casks may be filled with corn-cobs or beech chips; over these lay a coffee sack, and cover it with fine shavings, to keep the heat in. Next throw some good vinegar on the shavings, and let it soak in for a few hours; then draw it off through the faucet and throw it on to the shavings again, repeating this until the shavings are thoroughly soured, and adding each time 1 quart of high wines to the vinegar before throwing it back on the shavings; this addition prevents the vinegar from becoming flat by the absorption of the acid by the shavings. Then mix 1 gallon 90 per cent. high wines, and 1 quart molasses, with 14 gallons river water; pour it upon the shavings; draw it off and put it on the shavings again 2 or 3 times a day until sour. By using several casks, sufficient vinegar may be made at a time to put into barrels. Sour ale, or the rinsings of sugar hogsheads, may be poured on the shavings and turned into good vinegar in this way. It is better for the fluid to be weak at first, adding the molasses or other material being converted into vinegar, by degrees during the successive drawings. By following this plan, the strength of the vinegar may be gradually increased to almost any degree.

1740. To Make Good Cider Vinegar. Take 10 gallons apple juice fresh from the press, and suffer it to ferment fully, which may be in about 2 weeks, or sooner if the weather is warm; and then add 8 gallons like juice, new, for producing a second fermentation; in 2 weeks more add another like new quantity, for producing a third fermentation. This third fermentation is material. Now stop the bunghole with an empty bottle, with the neck downward, and expose it to the sun for some time. When the vinegar is come, draw off one-half into a vinegar cask, and set it in a cool place above ground, for use when clear. With the other half in the first cask, proceed to make more vinegar in the same way. Thus one cask is to make in, the other to use from. When making the vinegar, let there be a moderate degree of heat, and free access of external air. The process is hastened by adding to the cider, when you have it, a quantity of the mother of vinegar, as it is called—a whitish, ropy coagulum, of a mucilaginous appearance, which is formed in the vinegar and acts as a ferment. The strength of vinegar depends on the amount of sugar or starchy matter to be utimately converted into acetic acid.

1741. To Make Alcohol Vinegar. The following is the German method of making acetic acid, and is excellent and simple: In a bell glass or tall glass case, arrange shelves a few inches apart, one above another, on which place small flat dishes of earthenware or wood; then fill these dishes with alcohol, and suspend over each, in small trays or capsules, a portion of the black powder of platina (*see Platinum-Black*); hang strips of porous paper in the case, with their bottom edges immersed in the spirit to promote evaporation. Set the apparatus in a light place at a temperature of from 68° to 86° Fahr., for which purpose the sunshine will be found convenient. In a short time the formation of vinegar will commence, and the condensed acid vapors will be seen trickling down the sides of the glass, and collecting at the bottom, whence it may be removed once or twice a day. We shall find that during this process, produced by the mutual action of the platina and the vapor of alcohol, there will be an increase of temperature, which will continue till all the oxygen contained in the air enclosed in the case is consumed, when the acetification will stop; the case must then be opened for a short time, to admit of a fresh supply of air, when the operation will commence again.

1742. Artus' Process for the Manufacture of Vinegar. Dr. Artus has discovered a process for making vinegar from alcohol, which he says has proved entirely satisfactory. There is a very general complaint that the oxidation of spirits of wine in the vinegar process is far from complete, and that the results are not equal either in quality or quantity to what ought to be expected from the materials employed. His plan is as follows: Take ½ ounce dry bichloride of platinum, and dissolve it in 5 pounds alcohol; with this liquid moisten 3 pounds wood charcoal broken in pieces the size of a hazel-nut; heat these in a covered crucible, and afterwards put them in the bottom of a vinegar vat. Here the platinum in its finely divided spongy state absorbs and condenses large quantities of oxygen from the air, by which alcohol is rapidly oxidized. When the charcoal has been in use for 5 weeks it should be again heated in a covered crucible.

1743. To Improve Alcohol Vinegar. Vinegar made from pure alcohol and water does not possess the flavor of wine or cider vinegar, and is therefore inferior to them for table use; but a little acetic ether added to it renders it agreeable. Raw spirits containing some fusel oil produce a more pleasantly flavored vinegar than refined spirits; hence a few drops of fusel oil added to rectified spirits, in making the wash for vinegar, improves its aroma. A little oil of cloves or butyric ether added in the same manner improves its flavor. A very small quantity of cider vinegar gives a large quantity of whiskey vinegar a pleasant flavor. An infusion of chicory is sometimes added to high wine vinegar, to give it the color of cider vinegar.

1744. To Keep Up a Constant Supply of Cheap Vinegar. A supply of vinegar can be kept constantly on hand by retailers in the following manner: Before a barrel is quite sold out, fill up the barrel with 1 gallon molasses to every 11 gallons soft water. This mixture will become good vinegar in about 3 weeks—and can be treated in its turn in the same way. Where less than a barrel a week is used, 3 barrels thus treated and used in rotation, will be sufficient to keep up a perpetual supply. If the barrels stand on end, there must be a hole made in the top, protected with gauze to keep out insects. If standing on the side, the bunghole must be left open and similarly protected.

1745. To Make Vinegar in Three Weeks. Mix in the following proportions: 1 quart molasses, 1 pint yeast to 3 gallons warm rain water. Put the mixture into a keg or barrel with the bunghole open, but protected with gauze against insects.

1746. Distilled Vinegar. Put 1 gallon vinegar in a retort; and distill by a sand-bath, 7 pints. This should produce a vinegar of specific gravity 1.0065. The use of a lead or pewter worm must be avoided, as it renders the product cloudy and poisonous.

1747. To Make Vinegar from Sugar. An excellent domestic vinegar may be made by dissolving 1¼ pounds sugar to each gallon water used, with ¼ pint good yeast. If the heat of the mixture be maintained at 70° to 80° Fahr., acetification will set in, so that in 2 or 3 days it may be racked off from the sediment into a cask; it then receives the addition of 1 ounce cream of tartar, and 1 ounce crushed raisins; when completely free from sweet taste, it should be bottled and corked closely. The juice of currants, gooseberries, and many other fruits, and of beets, may be thus made into vinegar, either alone or in combination with syrup. Vinegar made in this manner keeps better than that made from malt liquors.

1748. Tests for Vinegar. The methods of testing the *strength* of vinegar are given under the head of *Acetimetry*. The following tests of purity will be found useful:

Paper written on or smeared with pure vinegar, is not charred when strongly warmed before the fire; if it is, the vinegar contains fully 2 per cent. of sulphuric acid.

Dip a small porcelain capsule or china cup into a solution of ½ ounce sugar in 15 ounces water, and then heat the capsule to a temperature of 212° Fahr. A drop of vinegar let fall on it will not be materially discolored if pure; it will turn a dark brown or black, if the vinegar contains only $\frac{1}{300}$ part of sulphuric acid; the presence of $\frac{1}{1000}$ of sulphuric acid will cause the spot to turn an olive green; a less proportion will produce a pale green color.

Chloride of barium testifies the presence of the same acid by forming a heavy white precipitate; each grain of this precipitate, after being dried and gently ignited, represents .344 grain of dry sulphuric acid; and if the precipitate from 1000 grains of vinegar exceed 2½ grains, it contains an undue proportion of sulphuric acid.

If a solution of nitrate of silver gives a cloudy white precipitate, hydrochloric acid is present.

If, after the addition of 2 or 3 grains carbonate of potash, and evaporation of the sample to dryness, the residuum deflagrates when ignited, the sample contains nitric acid.

1749. To Strengthen Weak Vinegar. If in pickles, turn it off, heat it scalding hot, put it in the pickles, and when lukewarm, put in a small piece of alum the size of a filbert, and a brown paper 4 inches square, wet with molasses. If it does not grow sharp in 2 weeks it is past recovery, and must be thrown away. Or, freeze it and remove the ice which forms on the surface. The water of the vinegar alone freezes, leaving the acetic acid in solution in the remaining water.

1750. To Determine the Strength of Vinegar. The hydrometer is not to be much relied on in testing the strength of vinegar. The simplest test is to take a fragment of fine marble, weigh it and suspend it by a thread in a known measure of vinegar until all action ceases and the liquid has no longer a sour taste. Take out the marble, wash and dry it, and note the loss of weight it has sustained. $\frac{5}{6}$ of this is real (hydrated) acetic acid. An ounce of good vinegar should saturate from 30 to 32 grains of pure and dry carbonate of soda; such vinegar contains about 5 per cent. of anhydrous (absolute) acetic acid. Vinegar above 30 per cent. of real acid will dissolve the essential oils and camphor. The strength of vinegar may also be ascertained in the same way as any other acid (*see Nos.* 69 *and* 78); but vinegar manufacturers designate the strength of their products by the number of grains of pure carbonate of potassa required to neutralize 1 fluid ounce of the vinegar tested. Thus, if 1 fluid ounce of a sample of vinegar requires 16 grains of carbonate of potassa to neutralize it, the vinegar is said to be of a strength of 16 grains.

1751. To Deprive Vinegar and Other Vegetable Liquids of their Color. To take away the color of vinegar, 2 pints red wine vinegar, cold, are mixed with 1½ ounces bone-charcoal (prepared as directed in the next receipt) in a glass vessel. Shake this mixture from time to time, and in 2 or 3 days the color completely disappears. When the process is to be performed in the large way, throw the charcoal into a cask of vinegar, which must be stirred from time to time. The highest colored *red wines* treated in the same manner become perfectly limpid. Ivory-black possesses the same property as bone-black. Filtering through charcoal will produce the same result.

1752. To Prepare Animal Charcoal to Decolorize Vinegar and other Vegetable Liquids. Fill a crucible with the most compact parts of ox and sheep bones, lute the cover, carefully leaving only a small opening at the top, place the crucible on a forge fire, and heat it gradually till red; when the flame from the oily and gelatinous parts has ceased, diminish the opening and suddenly raise the fire; when cold, reduce the charcoal to fine powder. (*See No.* 1729.)

Sauces, Catsups, and Pickles.

The following receipts are given to illustrate the methods employed in preparing a number of well known condiments. This department of our work might have been greatly extended, but it was not thought advisable to occupy space with particulars that may be found in any of the popular treatises on cookery:

1754. **Soy.** The pure article is imported from China, but an excellent substitute may be prepared by boiling 1 gallon of the seeds of Dolichos soja (if this cannot be had, haricot or kidney beans will answer) in sufficient water until soft; add 1 gallon bruised wheat, and keep in a warm place for 24 hours; then add 1 gallon salt, and 2 gallons water, and keep for 2 or 3 months in a tightly bunged stone jar; after which, press out the liquor.

1755. **Epicurean Sauce.** Indian soy, 2 ounces; walnut catsup, mushroom catsup, each 8 ounces; port wine, 2 ounces; bruised white pepper, ½ ounce; shallots, 3 ounces; cayenne, ¼ ounce; cloves, ⅛ ounce. Macerate for 14 days in a warm place, strain, and add white wine vinegar to make up a pint.

1756. **Kitchener's Sauce Superlative.** Port wine, and mushroom catsup, of each 1 pint; walnut or other pickle liquor, ½ pint; pounded anchovies, 4 ounces; fresh lemon-peel cut thin, sliced shallots, and scraped horseradish, of each 1 ounce; allspice and black pepper, of each ½ ounce; cayenne, 1 drachm; curry powder, 3 drachms; celery seed, 1 drachm; put them into a wide-mouthed bottle, stop it close, shake daily for 2 weeks, and strain; ¼ pint soy may be added.

1757. **To Make Quin Sauce.** Mix together 2 gallons walnut catsup, 2 gallons mushroom catsup, 1 gallon soy, 1 pound garlic, and 6 pounds sprats. Boil for 15 minutes, strain and bottle.

1758. **To Make Harvey's Sauce.** Take 48 parts Quin sauce, 16 parts soy, and 1 part cayenne.

1759. **Worcestershire Sauce.** Mix together 1½ gallons white wine vinegar, 1 gallon walnut catsup, 1 gallon mushroom catsup, ½ gallon Madeira wine, ½ gallon Canton soy, 2½ pounds moist sugar, 19 ounces salt, 3 ounces powdered capsicum, 1½ ounces each of pimento and coriander, 1½ ounces chutney, ¾ ounce each of cloves, mace and cinnamon, and 6½ drachms assafœtida dissolved in 1 pint brandy 20 above proof. Boil 2 pounds hog's liver for 12 hours in 1 gallon of water, adding water as required to keep up the quantity; then mix the boiled liver thoroughly with the water; strain it through a coarse sieve. Add this to the sauce.

1760. **Indian Curry.** The true Indian curry is said to be thus made: Coriander seed, 6 drachms; turmeric, 5 scruples; fresh ginger, 4½ drachms; cummin seeds, 18 grains; black pepper, 54 grains; poppy seed, 94 grains; garlic, 2 heads; cinnamon, 1 scruple; cardamom, 5 seeds; 8 cloves, 1 or 2 chillies; half a cocoa-nut grated; all but the last to be ground on a stone.

1761. **Italian Tamara.** Coriander seed, cloves, and cinnamon, of each 8 ounces; anise and fennel seeds, of each 4 pounds; mix.

1762. **Bengal Chutney.** Chillies, 1½ pounds; unripe mangoes (or apples), 1 pound; red tamarinds, 2 pounds; sugar candy, 1 pound; fresh ginger root, 1½ pounds; garlic, ¾ to 1½ pounds; sultana raisins, 1½ pounds; fine salt, 1 pound; and 5 bottles of the best vinegar; soak the chillies for 1 hour in the vinegar, then grind all with a stone and muller to a paste.

1763. **Kitchener's Essence of Soup Herbs.** Take of lemon thyme, winter savory, sweet marjoram, and sweet basil, of each 1 ounce; grated lemon peel and eschalots, of each ½ ounce; bruised celery seed, ¼ ounce; proof spirit, 1 pint. Digest for 10 to 14 days. A superior flavoring essence for soups, gravies, seasonings, &c.

1764. **Essence of Savory Spices.** Take of ground black pepper, 4 ounces; powdered turmeric, 3 drachms; ground coriander seeds, 1½ drachms; oil of pimento, 1½ fluid drachms; oil of nutmeg, oil of cloves, oil of cassia, and oil of caraway, of each ½ drachm; alcohol, 1 pint. Digest with agitation for 2 weeks.

1765. **Tincture of Savory Spices.** Take of black pepper, 1½ ounces; allspice, 5 drachms; nutmegs and burnt sugar, of each ¼ ounce; ground cloves, cassia, coriander and caraway seeds, of each 1 drachm; proof spirit, 1 pint. Digest with agitation for 2 weeks; press and filter. Used for flavoring. When made with alcohol and double the above weight of spices it makes an *essence* of savory spices.

1766. **Cautions in the Preparation of Catsups, &c.** In preparing catsups, pickles, &c., vessels of earthenware, stoneware or well-tinned copper pans should alone be used, as salt, vegetable juices and vinegar rapidly corrode copper, and render the results poisonous. Nothing in the shape of copper, lead, or pewter should be allowed to come in contact with them at any time. Even a plated copper spoon left in a bottle of catsup for some time will render its contents poisonous. Unpleasant and even dangerous attacks of vomiting, colic, and diarrhœa have resulted from neglect of these precautions.

1767. **Mushroom Catsup.** Lay alternate layers of mushrooms and salt in an earthenware pan, using ¼ pound of salt to each 2 quarts of mushrooms. After 6 hours, break them into pieces, and set in a cool place for 3 days, stirring every morning. Next strain, and to every quart of the juice add ½ ounce each allspice and ginger, ½ tea-spoonful powdered mace, and 1 tea-spoonful cayenne pepper. Put it into a closely covered stone jar, set in a pan of boiling water, and boil briskly for 5 hours; then empty it into a porcelain lined kettle and simmer gently for ½ hour; let it stand over night in a cool place to settle. Decant the clear liquor and cork tightly in bottles filled to the mouth. It is better to seal the corks and tie down with bladder, and to use small bottles, as it soon spoils when exposed to the air.

1768. Tomato Catsup. Take 1 peck ripe tomatoes, cut a slit in them, and put them into a porcelain lined kettle. Boil until the pulp is dissolved; strain and press, first through a cullender, then through a hair-sieve; then boil for 5 hours with 1 ounce salt, 1 ounce mace, 1 table-spoonful black pepper, 1 tea-spoonful cayenne, 1 table-spoonful powdered cloves, 7 of ground mustard, and 1 of celery seed; this last tied in a thin muslin bag; stir frequently, especially during the last hour; turn it into a stone jar to cool; and, when cold, add 1 pint strong vinegar; take out the bag of celery seed, and bottle. Seal the corks, and keep in a dark cool place.

1769. Tomato Catsup. Cut ½ bushel tomatoes to pieces, and boil them in their own liquor until soft; strain and press through a hair-sieve to separate the skins and seeds; boil down to a thick pulp, stirring all the time; then add 6 ounces salt, 6 drachms allspice, 1 ounce 5½ drachms yellow mustard, 3 ounces black pepper, 6 drachms cloves, 3 drachms mace, 2 drachms cayenne pepper, and 1 gallon vinegar. The spices must all be ground fine before using them. Let the whole boil up twice, and, when cool, bottle.

1770. Walnut Catsup. Take young, tender walnuts, prick them in several places, bruise them with a wooden billet, and place in a jar with sufficient water to cover them, adding a handful of salt for every 25 walnuts; stir them twice a day for 14 days; then drain off the liquor into a saucepan. Cover the walnuts with boiling vinegar, crush to a pulp and strain through a cullender into the liquor in the saucepan. Add, for every 2 quarts, 2 ounces each black pepper and ginger, 1 ounce each cloves and nutmeg pounded fine, a pinch of cayenne, a shallot minced fine, and a thimbleful of celery seed tied in a muslin bag. Boil all together for an hour, and, when cold, bottle. In the above manner an excellent catsup may be made from butternuts.

1771. Tarragon Vinegar. Put fresh tarragon leaves into a stone jar, and pour on them a sufficient quantity of the best wine vinegar to cover them. Set the jar in a warm place for 14 days; then strain through a jelly bag. In the same way may be made *elder-flower, basil, green mint,* and *Burnet* vinegars.

1772. Cress and Celery Vinegars are made with ½ ounce of the bruised seed to a quart of vinegar.

1773. Horseradish Vinegar, with 3 ounces of the scraped root, 1 ounce of minced shallots, 1 drachm cayenne, to 1 quart vinegar.

1774. Garlic Vinegar is made with 2 ounces minced garlic to 1 quart wine vinegar.

1775. Shallot Vinegar in the same manner, using challots instead of garlic.

1776. Chili Vinegar, with 50 chillies (peppers) cut or bruised (or ¼ ounce cayenne pepper), to 1 pint of the best vinegar; digest for 14 days, strain, and keep in *half-pint bottles.*

1777. Camp Vinegars. Take 12 chopped anchovies, 2 cloves of garlic minced, 1 drachm cayenne, 2 ounces soy, 4 ounces walnut catsup, and 1 pint best vinegar; digest for 1 month, and strain. Or: Vinegar, 1 quart; walnut catsup, 1 pint; mushroom catsup, 3 table-spoonfuls; garlic, 4 heads; cayenne, ½ ounce; soy, 2 table-spoonfuls; port wine, 2 glasses; 3 anchovies, and 1 table-spoonful of salt; put them into a bottle, shake daily for a month, and decant.

1778. Curry Vinegar. Infuse 3 ounces curry powder in 1 quart vinegar, near the fire, for 3 days.

1779. Superfine Raspberry Vinegar. Pour 1 quart vinegar on 1 quart raspberries; the next day press and strain the juice upon another quart of the fruit, and repeat this every day for 6 days. Then add 1 pound white sugar to every pint of the vinegar, and put it into a jar, which must be placed in a pot of boiling water to be scalded through.

1780. Fine Raspberry Vinegar. Bruised ripe raspberries and white wine vinegar, of each 3 pints; macerate 24 hours, press, strain, and to each pint add white sugar, 1 pound; boil, skim, cool, and to each pint add brandy, 2 ounces. In a similar way may be made *Strawberry Vinegar* and *Cherry Vinegar.*

1781. Raspberry Vinegar. Macerate 2 pounds fresh raspberries with 1 pint best vinegar for 14 days, and strain; or, to 1 quart of juice add 2 ounces strong acetic acid or enough to render it sufficiently acid.

1782. Raspberry Vinegar from Raspberry Syrup. Mix together 2 pints raspberry syrup and ½ fluid ounce acetic acid. Added to iced water according to taste, this is one of the most delightful of refrigerant drinks.

1783. Eschalot Wine. Bruised shallots, 3 ounces; sherry wine, 1 pint; infuse for 10 days; 1 ounce scraped horseradish and 1 drachm thin lemon-peel may be added. Dr. Kitchener says this is the most elegant preparation of the onion tribe. Wines of several herbs may be made in the same proportion as the vinegars.

1784. Table Mustard. Mix 8 spoonfuls of flour of mustard with 2 of salt and 9 of water. Mix to a smooth paste, add 6 spoonfuls more water, and mix.

1785. Le Normand's Superior Table Mustard. Take of best flour of mustard, 2 pounds; fresh parsley, chervil, celery, and tarragon, of each ½ ounce; garlic, 1 clove; 12 salt anchovies (all well chopped); grind well together, add of salt, 1 ounce; grape juice or sugar sufficient to sweeten, with sufficient water to form the mass into a thinnish paste by trituration in a mortar. When put into pots, a red-hot poker is to be thrust into each, and a little vinegar afterwards poured upon the surface.

1786. Soyer's Table Mustard. Steep mustard seed in twice its bulk of distilled vinegar for 8 days; grind to a paste, and put it into pots, thrusting a red-hot poker into each.

1787. Moutarde à l'Estragon. Gently dry 1 pound black mustard seed; then powder it fine, and mix it with 2 ounces salt, and sufficient tarragon vinegar to make a paste. In a similar way are prepared several other mustards, by employing vinegars flavored with the respective substances, or walnut or mushroom catsup, or the liquors of the richer pickles, in proportions to suit the taste.

1788. Moutarde Superbe. Take of salt, 1½ pounds; scraped horseradish, 1 pound; garlic, 2 cloves; boiling vinegar, 2 gallons; macerate in a covered vessel for 24 hours; strain, and add of flour of mustard a sufficient quantity.

1789. To Make Cayenne Pepper. This is prepared from the pods of the Chili or bird-pepper. The ripe pods, dried in the sun, are placed in layers with wheaten flour in a dish or tray, and exposed in a stove room or half cold oven until perfectly dry; they are then removed from the flour and ground to fine powder; to every ounce of this powder, 15 ounces wheaten flour are added, and made into a dough with a little tepid water and a tea-spoonful of yeast; after fermentation is well set up, the dough is cut into small pieces, and baked in a slow oven until perfectly hard and brittle. It is then beaten or ground to powder, and forms cayenne pepper.

1790. Pickles. In making pickles, use none but the best cider vinegar. Never keep pickles in glazed earthenware, but in glass or hard stoneware, and well covered with vinegar. They should be examined every month or two, and soft pieces removed. If there is much tendency to soften, it is advisable to strain off the vinegar, add to each gallon a cupful of sugar, boil it, and return it to the pickle jar while hot. The occasional addition of a little sugar keeps pickles good, and improves them. Spices in pickles should be used whole, slightly bruised, but preferably not ground; if ground, they should be tied up in thin muslin bags. Most pickles, if well kept, improve with age, by the vinegar losing its raw taste, and the flavor of the spices, &c., improving and blending. (*See No.* 1766.)

1791. Spiced Vinegar for Pickles Generally. Bruise in a mortar 2 ounces black pepper, 1 ounce ginger, ½ ounce allspice, and 1 ounce salt. If a hotter pickle is desired, add ½ drachm cayenne, or a few capsicums. For walnuts add also 1 ounce shallots. Put these in a stone jar, with a quart of vinegar, and cover them with a bladder wetted with the pickle, and over this a piece of leather. Set the jar near the fire for 3 days, shaking it 3 times a day; then pour it on the walnuts or other vegetables. To save time, it is usual to simmer the vinegar gently with the spices, which is best done in an enameled saucepan. For walnuts it is used hot; for cabbage, &c., cold.

1792. Pickled Cauliflower. These should be sliced, and salted for 2 or 3 days, then drained, and spread upon a dry cloth before the fire for 24 hours; after which they are put into a jar, and covered with spiced vinegar. Dr. Kitchener says that if vegetables are put into cold salt and water (¼ pound salt to 1 quart water) and gradually heated to a boiling heat, it answers the same purpose as letting them lie some days in salt.

1793. Pickled Cucumbers. Gherkins. Small cucumbers, but not too young, are wiped clean with a dry cloth, put into a jar, and boiling vinegar, with a handful of salt, poured on them. Boil up the vinegar every 3 days, and pour it on them till they become green; then add ginger and pepper, and tie them up close for use. Or cover them with salt and water (as above) in a stone jar, cover this and set them on the hearth before the fire for 2 or 3 days, till they turn yellow; then put away the water, and cover them with hot vinegar, set them near the fire, and keep them hot for 8 or 10 days, till they become green; then pour off the vinegar, cover them with hot spiced vinegar, and keep them close. Half a dozen peppers improve a jar of cucumbers, as the heat of the former is absorbed by the latter.

1794. Pickled Onions. Let them lie in strong salt and water for 2 weeks; then take them out and peel them; put them in fresh salt and water for 2 weeks more; take them out, wash them clean, and let them lie in fresh water all night. Next day place them on a cloth to drain; then put them in a jar, and pour over them hot spiced vinegar. If you wish them of a nice color, use white vinegar.

1795. Pickled Onions. Peel small silver button onions, and throw them into a stew-pan of boiling water; as soon as they look clear, take them out with a strainer-ladle, place them on a folded cloth covered with another, and when quite dry put them into a jar and cover them with hot spiced vinegar. (*See No.* 1791.) When quite cold, bung them down, and cover with bladder wetted with the pickle.

1796. Pickled Peppers. Soak fresh hard peppers in salt and water for 9 days, in a warm place, changing the brine every day. Then put them into cold vinegar. If the pickles are not required very hot, take out the seeds from the greater portion of the peppers.

1797. Beetroot Pickles. Simmer the roots till 3 parts done (from 1½ to 2½ hours); then take them out, peel and cut them in thin slices. Put them into a jar, and pour on sufficient cold spiced vinegar (*see No.* 1791) to cover them.

1798. Pickled Walnuts. Take 100 young walnuts, lay them in salt and water for 2 or 3 days, changing the water every day. (If required to be soon ready for use, pierce each walnut with a larding pin, that the pickle may penetrate.) Wipe them with a soft cloth, and lay them on a folded cloth for some hours. Then put them in a jar, and pour on sufficient hot spiced vinegar (*see No.* 1791) to cover them. Or they may be allowed to simmer gently in strong vinegar, then put into a jar with a handful of mustard seed, 1 ounce ginger, ¼ ounce mace, 1 ounce allspice, 2 heads of garlic, and 2 split nutmegs, and pour on them sufficient boiling vinegar to cover them. Dr. Kitchener recommends the walnuts to be gently simmered with the brine, then laid on a cloth for a day or two, till they turn black, put into a jar, and hot spiced vinegar poured on them.

1799. Pickled White Cabbage. Cut white cabbage into thin slices, put it into an earthen pan, sprinkle with salt, and let it lie for 2 days; then drain and spread it out before the fire for some hours; put it into a stone jar, and add sufficient white vinegar, or pale white vinegar, to cover, with a little mace and a few white pepper-corns.

1800. Pickled Red Cabbage. Remove the outer leaves and stalks, and cut the cabbage in quarters, then shred them into a cullender, and sprinkle with salt; next day drain, put them into a jar, and pour on sufficient cold spiced vinegar to cover them. (*See No.* 1791.) Others hang up the cabbage for a few days to dry, then shred the leaves, and put them in layers in a jar with a little salt, pepper, and ginger, and fill up with cold vinegar. Others use vinegar without spice.

1801. Pickled Nasturtiums, French Beans, and other small green vegetables, are made in the same manner as directed for gherkins. (*See No.* 1793.)

1802. Pickled Mushrooms. Clean the mushrooms with water and flannel, throw them into boiling salt and water in a stewpan, and boil for a few minutes. Drain them in a cullender, and spread out on a linen cloth, covering them with another. Put into bottles with a blade or two of mace, and fill up with white vinegar, pouring some melted mutton fat on the top, if intended to be kept long.

1803. Pickled Tomatoes. Tomatoes are pickled in the same manner as cucumbers. (*See No.* 1793.)

1804. Imitation Pickled Mangoes. Large cucumbers, or small melons, are split so that a marrow-spoon may be introduced, and the seeds scooped out; they are then parboiled in brine strong enough to float an egg, dried on a cloth before the fire, filled with mustard seed and a clove of garlic, and then covered with spiced vinegar. (*See No.* 1791.) Real mangoes are pickled in the same way.

1805. Piccalilli, Indian, or Mixed Pickle. To each gallon strong vinegar put 4 ounces curry powder, 4 ounces good flour of mustard, 3 ounces bruised ginger, 2 ounces turmeric, 8 ounces skimmed shallots, and 2 ounces garlic, the last two slightly baked, ¼ pound salt and 2 drachms cayenne pepper. Digest these near the fire, as directed in No. 1791 for spiced vinegar. Put into a jar, gherkins, sliced cucumbers, sliced onions, button onions, cauliflower, celery, French beans, nasturtiums, capsicums, large cucumbers, and small melons. All except the capsicums to be parboiled in salt and water, drained, and dried on a cloth before the fire. The melons and large cucumbers to be prepared as directed in last receipt for mangoes. Pour on them the above pickle.

1806. Mixed Pickle. Take 1 pound ginger-root and ½ pound garlic (both previously salted and dried), 2 gallons vinegar, ½ ounce turmeric, and ¼ pound long pepper. Digest together for 2 or 3 days near the fire in a stone jar; or gently simmer them in a pipkin or enameled saucepan. Then put in almost any vegetables except red cabbage and walnuts, all previously salted and dried.

Yeast. Yeast is either the froth or the deposit of fermenting worts, according to the character of the fermentation. According to Liebig, yeast is a substance in a state of putrefaction or fermentation, the atoms of which are in a continual motion, and this condition it communicates by contact, to fermentable substances. Lüdersdorff considers yeast an organic body, acting on the sugar contained in the saccharine solution, and not by mere contact and communication of its own condition. This view receives considerable support by examination of its particles by a microscope, and also from its fermenting power being destroyed by trituration or strong pressure. Cooley believes both views to a certain extent correct, and that the atoms in a state of continual motion or change, referred to by Liebig, are developed by the organs of vital yeast, when in contact with sugar under circumstances favorable to fermentation.

1808. Preparation of Brewers' Yeast. To do this, 72 pounds unkilned malt and a handful of hops are gradually stirred in a clean tub containing 7 gallons water of 170° Fahr.; and to this 5½ gallons water of 200° are added. The tub is then covered tightly and left quiet for 1 hour. Supposing this to be done at 6 P. M., the whole is left undisturbed till 7 o'clock next morning, when it must be cooled rapidly, which is done by setting in cans filled with cold water. When the temperature of the mash has reached 70°, the tub is covered again and left during the day till 6 P. M.; at this time 1½ gallons fresh beer yeast are to be stirred in. In 12 hours pierce a hole in the layer formed by the husks of the malt, and dip 3½ gallons of the liquor beneath, then stir the whole up and dip 1¾ gallons from it (husks and liquor). This is the mother-barm, from which you can generate yeast all the year round in using it in the way described instead of the ordinary beer leaven. To the remainder in the tub add 5 gallons wort of 90° (*see No.* 858), and make use of it in within 2 hours. The mother-yeast also must be used the same day for fermenting another portion.

1809. Yeast for Hot Climates. Boil 2 ounces of the best hops in 4 quarts water for ½ hour; strain it, and let the liquor cool down to new milk warmth. Then put in a small handful of salt and ½ pound brown sugar; beat up 1 pound best flour with some of the liquor, and mix all well together. The third day add 3 pounds potatoes boiled and mashed, and let it stand until the next day. Then strain, and it is ready for use. Stir frequently while making, and keep near a fire. Before using, stir well; it will keep 2 or 3 months in a cool place. This yeast is very strong; half the usual quantity necessary for a baking is sufficient. This yeast may be kept in a temperature as high as 104° Fahr.

1810. To Prepare Yeast without a Ferment. Common wheat flour is to be mixed with water into a thick paste, and kept, slightly covered, in a moderately warm place, for some time. About the third day it begins to emit a little gas, and to exhale a disagreeable, sour odor, like stale milk; after the lapse of a few days, that is, about the sixth or seventh day, the smell changes, much gas is evolved, accompanied by a distinct and agreeable vinous odor, and it is then in a state to excite the vinous fermentation. A quantity of wort is next to be prepared, and boiled with hops, in the same manner as in the brewing of beer (*see No.* 858), and when cooled to 90° or 100° Fahr., the decomposed dough, thoroughly mixed with tepid water, is to be added, and the whole kept in a warm situation. After the lapse of a few hours, active fermentation takes place, carbonic acid is disengaged, and when the action is complete, and the liquor clear, a large quantity of yeast, of excellent quality, is found at the bottom of the vessel.

1811. To Make Yeast without a Ferment. Boil ¼ peck malt in 3 pints water; pour off 2 pints, and keep it in a warm place for 30 hours; add 4 pints of a similar decoction, stir it well in, again ferment, and repeat this addition of 4 pints until a sufficient quantity of yeast is obtained; 10 pints will yield yeast sufficient for a brewing of 40 gallons; it is preferable to brewers' yeast, particularly when used for raising dough.

1812. To Make Good Yeast without Ferment. Put 2 ounces best hops into 9 pints cold water; boil ½ hour, strain while hot, and add 2 ounces fine table salt and ½ pound sugar. When the mixture becomes blood-warm, put 1 pound sifted flour into a large basin, make a well in the centre with the hand, add the liquor by degrees, stirring with a spoon until the whole is thoroughly incorporated. Let it stand for 2 days in a warm place, stirring it 3 or 4 times a day; then boil and mash finely 3 pounds good potatoes, and mix them in. After standing 1 day more, there should be a heavy dark scum on the surface. Stir it thoroughly, strain through a sieve or cullender, put it into a stone jar, cork and tie down firmly, and keep in a cool cellar. This is a self-fermenting yeast, improves by keeping if not left uncorked, and will not make sour bread.

1813. To Make Yeast with a Ferment. Mix 2 quarts water with wheat flour, to the consistence of thick gruel; boil it gently for ½ hour, and when almost cold, stir into it ½ pound sugar and 4 spoonfuls good yeast. Put the whole in a large jug or earthen vessel, with a narrow top, and place it before the fire, so that it may, by a moderate heat, ferment. The fermentation will throw up a thin liquor, which pour off and throw away; keep the remainder for use (in a cool place) in a bottle, or jug tied over. The same quantity of this as of common yeast will suffice to bake or brew with. 4 spoonfuls of this yeast will make a fresh quantity as before, and the stock may be always kept up, by fermenting the new with the remainder of the former quantity.

1814. Patent Yeast. Simmer 6 ounces hops in 3 gallons water for 3 hours; strain it, and in 10 minutes stir in ½ peck ground malt. Next re-boil the hops in water, and add the liquor to the mash already made, which must be well stirred up, covered over, and left for 4 hours; then drain off the wort, and when cooled down to 90° Fahr., set it to work with 1 pint yeast (patent is best); after standing for 20 to 24 hours, take off the scum, strain it through a coarse hair sieve, and it is ready for use. 1 pint is said to be enough for 1 bushel of bread.

1815. To Preserve Yeast. Ordinary beer yeast may be kept fresh and fit for use for several months, by placing it in a close canvas bag, and gently squeezing out the moisture in a screw press till the remaining matter becomes as stiff as clay, in which state it must be preserved in close vessels.

1816. To Remedy Bitterness in Yeast. Yeast is often so bitter as to communicate a most disagreeable taste to bread. This may be derived from an excess of hops. To rectify this, mix with the yeast a considerable quantity of water, and set it by to rest for some hours, when the thickest part will fall to the bottom. Pour off the water, which will have extracted part of the bitter principle, and use only the stiff portion that has fallen to the bottom. But yeast sometimes acquires a bitter taste from keeping, which is quite independent of that derived from the hops. To remedy this, throw into the yeast a few clean coals freshly taken from the fire, but allowed to cool a little on the surface. The operation appears to depend in principle upon the power of freshly burnt charcoal to absorb gases and remove offensive odors.

1817. Baking Powder. This is chiefly employed as a substitute for yeast. 1 or 2 tea-spoonfuls are mixed with the dry flour and other ingredients, which are then made into a dough, as quickly as possible, with cold water, and at once baked or boiled, as the case may be. By the addition of about ½ drachm turmeric powder to each pound of baking powder, it is converted into *egg powder*. These preparations should be kept in well corked bottles or tins, to prevent absorption of moisture.

1818. To Make Baking Powder. Powder and thoroughly dry separately, by gentle heat, ½ pound tartaric acid, ¾ pound pure bicarbonate of soda, and ¾ pound potato farina; mix them in a dry room, pass the mixture through a sieve, and at once put into packages, observing to press it hard, and to cover it with tinfoil or close-made paper, and to preserve it as much as possible from air and moisture. Or: Mix and pack, as just described, ¼ pound tartaric acid, ½ pound alum, ¾ pound pure bicarbonate of soda, 1 pound farina, and 3 ounces sesquicarbonate of ammonia. Or: 5 pounds tartaric acid, 8 pounds pure sesquicarbonate of soda, and 16 pounds farina. In using, 1 or 2 tea-spoonfuls are mixed with the dry flour, which is then made up quickly with cold water, and baked immediately. Any other flour or starch may be used instead of the potato flour.

Receipts for the Flower and Kitchen Garden.

The aim of the following receipts is to afford information for the treatment of ornamental in-door plants, and for the general requirements and improvement of the flower and kitchen garden, without entering into the principles of either agriculture or horticulture.

1820. To Dissolve Bones for Manure. Break the bones into small pieces, or pulverize them, if the means are available; put them into a hole in the ground, or, preferably, a stone tank. Pour upon them about 40 pounds oil of vitriol to 100 pounds bones. Work the mixture with long wooden poles until the mass is uniform. Allow it to remain 24 hours, by which time it will be perfectly dry. A couple of shovelfuls added daily to a dung-heap will form a fine compost.

Bones may also be dissolved by filling an old barrel with alternate layers of wood ashes and fresh bones, slightly wetting from time to time with hot water. This is a more economical plan than by the use of sulphuric acid, and is said to make a more soluble compound.

1821. Composts for Improving the Soil. Composts are mixtures of several earths, or earthy substances, or dungs, either for the improvement of the general soil under cultivation, or for the culture of particular plants. In respect to composts for the soil of the garden, their quality must depend upon that of the natural soil; if this be light, loose, or sandy, it may be assisted by heavy loams, clays, etc., from ponds and ditches, cleanings of sewers, etc. On the other hand, heavy clayey and all stubborn soils may be assisted by light composts of sandy earth, drift, and sea-sand, the shovelings of turnpike roads, the cleansing of streets, all kinds of ashes, rotten tanners' bark, rotten wood, sawdust, and other similar light opening materials that can be most conveniently procured.

1822. To Prepare Composts. The preparation necessary for heavy and light composts for general enrichment, and of the above different earths, consists in collecting each soil in the compost ground, in separate ridges of 3 or 4 feet broad, and as high, turning them every 6 weeks or 2 months for a year or a year and a half before they are used. Peat earth, being generally procured in the state of turf full of the roots and tops of heath, requires 2 or 3 years to rot; but after it has lain 1 year it may be sifted, and what passes through a small sieve will be found fit for use. Some nurserymen use both these loams and peats as soon as procured, and find them answer perfectly for most plants; but for delicate flowers, and especially bulbs, and all florists' flowers, and for all composts in which manures enter, not less than 1 year ought to be allowed for decomposition and sweetening.

1823. Universal Composts. The preparation of many separate kinds of composts may be obviated by the general use of the following mixture: Fibrous peat, 1 part; leaf-mould, 2 parts; thoroughly rotted dung, 1 part; light hazelly loam, 4 parts; and 1 part sharp sand. There is scarcely any flowering plant but will grow well in such a mixture, and if peat is not to be had, an additional part of leaf-mould may take its place.

1824. Liquid Manure. The principal materials now used for liquid manures are to be used in the following proportions for all ordinary purposes: Guano, dissolve 50 pounds weight in 10 gallons water, and of this strong solution, add 5 ounces to 10 gallons of water for use. Sheep's-dung, 1 peck to 30 gallons. Sulphate of ammonia, 1¼ ounces to every gallon.

1825. Liquid Guano to Hasten the Blowing of Flowers. To hasten the blowing of flowers the following liquid has been used with great advantage: Sulphate or nitrate of ammonia, 4 ounces; nitrate of potash, 2 ounces; sugar, 1 ounce; hot water, 1 pint; dissolve and keep it in a well-corked bottle. For use, put 8 or 10 drops of this liquid into the water of a hyacinth-glass or jar for bulbous-rooted plants, changing the water every 10 or 12 days. For flowering plants in pots, a few drops must be added to the water employed to moisten them.

1826. Artificial Manure for Clover. Mix together 10 parts each sulphate of ammonia, common salt, and oil of vitriol; 15 parts chloride of potassium; 17 parts each gypsum (plaster of Paris) and sulphate of potassa; 20 parts saltpetre; 25 parts crude Epsom salt (sulphate of magnesia); and 33 parts sulphate of soda (Glauber salts.)

1827. Artificial Manure for Wheat, Turnips, or Grass. Take 28 pounds crude potash, 1 cwt. common salt, 2 cwt. each bone dust and gypsum (plaster of Paris), and 15 bushels wood ashes. Mix them together.

1828. Artificial Guano. Mix 11 pounds dry sulphate of soda (Glauber salts) with 28 pounds wood ashes; 84 pounds common salt; 112 pounds crude sulphate of ammonia; and 7 bushels bone dust.

1829. Fertilizing Powder. To 18 parts very fine bone dust add 1 part each gypsum (plaster of Paris) and sulphate of ammonia. The seed should be steeped in the drainings from a dunghill; and after being drained, but while still wet, should be sprinkled with the powder and then dried.

1830. Phosphate for Manuring. Macerate for some days, with frequent stirring, 2 parts crushed bones in 1 part oil of vitriol and 3 parts water. This forms a superphosphate of lime, which, mixed with water, dry earth, or sand, forms an excellent manure.

1831. How to Select and Manage Cuttings. The choice of cuttings should be made from the side shoots of trees and plants, and, when possible, from such as recline towards the ground, observing to leave a little wood of a former year or season's growth attached to them, as such are found to take root more readily than when they are wholly composed of new wood. The time to take cuttings is as soon as the sap gets into full motion. Before setting them they should be cut across, just below an eye or joint, with as smooth a section as possible, observing not to injure the bud. The superfluous leaves may be removed, but a sufficient number should be left on for the purposes of vegetation. The practice of removing all or nearly all of the leaves of cuttings is injudicious. In some cases leaves alone will strike root. In the case of tubular stalked plants, it is said to be advantageous to insert both ends into the soil, each of which will take root, and may then be divided, when two plants will be produced instead of one. An equable temperature, a moist atmosphere, a shady situation, and a moderate supply of water, are the principal requisites to induce speedy rooting. Excess of any of these is prejudicial. When the size of the cuttings admits, it is better to place them under a hand or bell glass, which will preserve a constant degree of heat, and prevent evaporation from the surface of the leaves, which is the most common cause of their dying, especially in hot, dry weather. What the degree of heat ought to be is decided by the degree of heat requisite for the mother plant. Most species of the erica, dahlia, and geranium, strike better when supplied with rather more heat than is requisite for the growth of these plants in green-houses. Cuttings of the myrtle tribe, camellias, and most other plants, require rather less heat than the plants in their growing state.

1832. To Insert Cuttings. Cuttings, if inserted in a mere mass of earth, will hardly throw out roots, while, if inserted at the side of the pot so as to touch the pot in their whole length, they seldom fail to become rooted plants. The art is to place them to touch the bottom of the pot; they are then to be plunged in a bark or hot-bed and kept moist.

1833. The Color of Flowers Changed by Charcoal. A horticulturist in England purchased a rose-bush full of promising buds —the flowers, however, were of a faded hue. He covered the earth in the pot about an inch thick with pulverized charcoal, and was surprised, some days afterward, to find the blooms of a fine lively rose color. He then tried the powdered charcoal upon petunias, and found that both the white and violet colored flowers were equally sensitive to its action. It always gave great vigor to the red or violet color of the flowers, and the white petunias became veined with red or violet tints; the violets became covered with irregular spots of a bluish or almost black tint. Many persons who admired them thought they were choice new varieties from the seed. Yellow flowers appear to be insensible to the influence of charcoal.

1834. To Turn White Flowers Red. The juice of the Virginian pokeweed sprinkled on the white hyacinth will turn it red. The same effect is produced on many other white flowers.

1835. To Preserve Cut Flowers. Place a vase containing the cut flowers in the centre of a flat dish, into which a little water has been poured; invert a bell glass over the vase, so that the rim of the glass is covered by the water, thus forming an air-tight chamber. The air surrounding the flowers will be constantly moist, and will remain so as long as the supply of water in the dish is kept undiminished. We recommend those who love to see plenty of fresh flowers in their sitting-rooms in dry weather, to adopt this plan. The experiment can be tried by inverting a tumbler over a rose-bud in a saucer of water. If some charcoal has been previously steeped in the water, or a small piece of camphor dissolved, it will greatly assist in keeping the flowers fresh. Violets may be preserved for a long time by sticking them with short stems into a glass dish filled with damp silver-sand, and then inverting a tumbler over them.

1836. To Preserve Flowers. Flowers may be preserved for many months by dipping them carefully, as soon as gathered, in perfectly limpid gum water; after allowing them to drain for 2 or 3 minutes, arrange them in a vase. The gum forms a complete coating on the stems and petals, and preserves their shape and color long after they have become dry.

1837. Preservation of Flowers with their Natural Colors. The mode in which the operation is effected is this: A vessel with a movable cover and bottom is provided, and having removed the cover from it, a piece of metallic gauze of moderate fineness is fixed over it, and the cover replaced. A quantity of sand is then taken, sufficient to fill the vessel, and passed through a sieve into an iron pot, where it is heated, with the addition of a small quantity of stearine, carefully stirred, so as to thoroughly mix the ingredients. The quantity of stearine to be added is at the rate of ½ pound to 100 pounds of sand. Care must be taken not to add too much stearine, as it would sink to the bottom and injure the flowers. The vessel, with its cover on and the gauze beneath it, is then turned upside down, and, the bottom being removed, the flowers to be operated upon are carefully placed on the gauze and the sand gently poured in, so as to cover the flowers entirely, the leaves being thus prevented from touching each other. The vessel is then put into a hot place, such, for instance, as the top of a baker's oven, where it is left for 18 hours. The flowers thus become dried, and they retain their natural colors. The vessel still remaining bottom upwards, the lid is taken off, and the sand runs away through the gauze, leaving the flowers uninjured.

1838. To Preserve Flowers in Water. Mix a little saltpetre or carbonate of soda with water, and it will preserve the flowers for 2 weeks.

1839. To Restore Faded Flowers. Faded flowers may be generally restored by immersing them half-way up their stems in very hot water, and allowing them to remain in it until it cools, or they have recovered. They must then be removed, the coddled portion of the stems cut off, and placed in clean cold water. In this way a great number of faded flowers may be restored, but there are some of the more delicate kinds on which it proves useless.

1840. To Raise Hyacinths in Winter. Put the bulbs in glasses or earth, and set them in a dark closet to sprout. If in glasses, the water should not be higher than 1 inch below the bulb, until the roots have reached the water, when the glasses may be filled up, a piece of charcoal put in the water, and the plants set in the sun to grow.

1841. Soot Water for Roses. Put the soot obtained from the pipe or chimney of a wood fire, into a pitcher, and pour hot water upon it. When cool, use the liquid occasionally to water the rose plants. Its effects are extraordinary in strengthening the growth of the plants and flowers.

1842. To Make Hydrangea Flowers Blue. If they are grown in a tolerably strong maiden loam, which contains a portion of oxide of iron, the flowers will become blue without further trouble; but they will require to be potted in this said compost, and continually grown in the same, from the cutting pot, to ensure their flowers coming blue. If the soil itself will not make the flower blue, they should be watered with a solution of alum for some time previous to flowering. The solution may be made by mixing at the rate of 1 ounce alum to a gallon of rain water. The plants should be struck from small cuttings of the soft wood, from February till May, that are required to flower in those months the following year. They should be potted in time enough for their roots to fill them before winter. It is advisable to flower them the following spring in the pots, allowing the plants to produce only one cluster of flowers each, and taking off all the suckers and side shoots to strike for flowering the following spring, as old plants cannot be depended upon to produce blue flowers. If $\frac{1}{6}$ part of iron filings be mixed with the earth in which the plant is grown, it will frequently, although not always, change from its original pink color to a light blue. A cutting, however, taken from the plant thus changed, and grown without iron filing, reverts to its previous color.

1843. **To Prevent Damping or Fogging Off.** Cuttings in heat, and seedlings pricked out, are very liable to damp off, if in a confined air, with too much moisture. The best mode of treatment is, as soon as evidences of damping appear, to give more air, and increase the temperature 5 degrees, and, at the same time, to sprinkle the surface of the soil with a mixture of silver-sand and powdered peat, crumbled to the fineness of snuff.

1844. **To Remedy American Blight.** Take $\frac{1}{2}$ peck quicklime, $\frac{1}{2}$ pound flowers of sulphur, and $\frac{1}{4}$ pound lampblack. Mix with boiling water, enough to form a thick paint. With this, in the winter, when the leaves are off, paint the branches, having first removed all loose bark. In doing this, be sure to remove the soil from the bottom of the stem to the main roots, and paint all the underground part. February is a good time for this. If one application is not sufficient, repeat. Use the paint warm. When this has become dry, the trees should be looked over, and all cracks and holes stopped with well worked clay, and after frost the clay-stoppings should be dressed again, to close any cracks that may occur.

1845. **To Destroy Aphides, and Other Insects on Plants.** Take of quassia chips, $3\frac{1}{2}$ ounces; larkspur seed, 5 drachms; boil these together in 7 pints water until the decoction is reduced to 5 pints. When the liquid is cooled it is to be strained, and used with a watering-pot or syringe, as may be most convenient. This is a most excellent method of destroying insects on plants, without injury to the latter. It is recommended by the highest authorities.

1846. **Blight on Fruit Trees, Roses, and Fruit Bushes.** When winter dressings have failed, and the pests appear in spring to such an extent as to endanger the crop, procure a quantity of ammoniacal liquor from the gas-works, and to every pailful of the liquor add 6 of water, and boil as soon as possible in a large copper. Apply this in the evening, hot, with a syringe, drenching every part of the trees, and letting not a leaf escape. It should be used as hot as can be borne by placing the hand in it, and thrown with as much force as possible into all the crevices in the bark, on the under sides of the leaves, and splashed vigorously against the wall on which espaliers are trained. It may be used also for roses and fruit bushes, with the most certain benefit. Two days after give another syringing with plain warm water. To clean the copper in which the mixture is prepared, fill it with water, throw in a shovel of cinder ashes and a pound of soda, and let it boil for half an hour.

1847. **To Prevent Ants from Injuring Fruit Trees.** Make a line of gas-tar round the stem of the tree, or if it be trained on a wall, make a horizontal line near the ground, on the wall, and one round the stem; this will prevent ants from ascending.

1848. **To Destroy Black Ants.** Boil 4 ounces quassia chips in 1 gallon water, for 10 minutes, and add 4 ounces soft soap. This is excellent to destroy black ants. Or: Sprinkle pulverized borax over the plants or places infested by these vermin. (*See No.* 1909.)

1849. **To Prevent Mildew on Trees.** The best preventive against mildew is to keep the plant subject to it occasionally syringed with a decoction of elder leaves, which will prevent the fungus growing on them.

1850. **To Remove Mildew from Roses, Pelargoniums, Etc.** Mildew has been successfully removed from roses and pelargoniums, by dissolving 1 ounce nitre to 1 gallon water, and watering the plants with it occasionally; another way is to wash the diseased parts with a decoction of elder leaves. But the most effectual remedy is flowers of sulphur dusted over the foliage, by means of a dredging-box with very fine holes.

1851. **To Remove Green Fly.** Choose a still evening, and let the plants be quite dry. Arrange them together in a close place; put into an iron pan, or a flower-pot, a few red-hot cinders that do not smoke, upon which lay the tobacco or tobacco-paper; a cloud of smoke will soon arise. When the frame is well filled with smoke, remove the pan, and be exceedingly careful that the tobacco does not break out into a flame.

1852. **To Fumigate Plants with Tobacco Smoke.** There are various modes of employing the smoke of tobacco for the destruction of insect pests in plant houses, but the best is as follows:—According to the size of the place to be fumigated provide one or more pieces of cast-iron 1 inch thick and 3 inches of surface. Make these red-hot and place each in a large-sized pot; and on them as much tobacco as may be considered necessary to completely fill the house with smoke. An ordinary eight-light house will require 3 heaters, and 1 pound of tobacco, divided into 3 equal parts. If the tobacco is previously soaked in a strong solution of saltpetre, its ignition is more rapid and complete, and a less quantity suffices.

1853. **To Drive Worms out of Pots.** Securely cork up all the drainage holes in the pot, and then flood it for several hours with clear lime-water.

1854. **To Destroy Green Fly.** Syringe the plants with tobacco water. One part ammoniacal liquor from the gas-works, mixed with 5 or more parts of water, according to its strength, will also destroy the insects.

1855. **Wash to Prevent Cattle from Barking Trees.** Take $\frac{7}{8}$ cow-dung and $\frac{1}{8}$ lime; mix with a little water, to the consistency of thick lime-wash, and lay this on the stems of the trees as far as the cattle can reach.

1856. **To Prevent Grub in Onions.** Make some strong lime-water, add to it as much soot as will make it into a thin paint, and water the crop with it the moment the maggot appears. This soot mixture is so stimulating a manure that it should always be used to increase the weight of the crop. House-slops mixed with lime and soot would be still more powerful, both to destroy maggot and improve the plant; but unless rain followed immediately, it would be advisable to drench the ground with pure water the day after application. Ground intended for a crop of large onions should be prepared in the autumn, and after being dug over, should be watered with a mixture of sulphuric acid and water, made so strong as to burn the tongue. This will destroy every animal in the soil, and the winter rains will wash it away entirely before spring.

1857. To Prevent Attacks of Red Spider. In cases where the infested plants can be well syringed, a few times repeating this operation will cause them to disappear. When this cannot be resorted to with safety, the flues or pipes may be washed over with sulphur, and should be kept warm to raise an effluvia in the house, which will soon eradicate these pests. If a little soft soap is mixed with the water to syringe with, it will prove obnoxious to many other insects as well as red spider, and will not injure the foliage of the plant, providing the plants are not syringed when the scorching hot sun is upon them.

1858. To Kill Thrips on Cucumbers and Melon Plants. To kill thrips on cucumbers and melon plants, they should be syringed with tobacco water, and a little sulphur added, or with a decoction of elder leaves; either of these repeated a few times will suffice; or the infested parts may be dusted over with flowers of sulphur, and allowed to remain on for 3 or 4 days, when it should be washed off thoroughly with a syringe. (*See No.* 1850.)

1859. To Destroy Maggot in Roses. A bushel of unslacked lime in powder, ½ pound sulphur also in powder; mix these well whilst dry, then add water to make it about as thick as molasses, and boil for 1 hour; then add just enough soot, moistened to the same consistence, to darken the color; lay this on with a brush all over, stock and head, in the latter part of March.

1860. To Destroy Moss on Fruit Trees. Every second year fruit trees should be well scrubbed with a scrubbing brush dipped in strong brine, so as to moisten every part of the bark of the stem and branches. This not only destroys the moss, but insects of all kinds, and is beneficial to all trees, whereas applications of lime choke up the respiratory pores, and sometimes produce canker.

1861. To Remove Moss on Gravel Walks. This may be kept down by the use of a broom made of wire; if the wire is made of iron the broom should be well dried and dipped in oil before and after being used.

1862. To Protect Lettuce and Strawberry Beds from Snails. If the beds are surrounded by a slate or board edging, made to stand 5 inches above the ground, and occasionally coated with a paste made of train oil and soot, it will form a barrier over which snails will not pass.

1863. To Prove Cucumber and Melon Seed. When the fruit is first cut, the seed should be put into a bowl of water, and that which swims on the surface is worthless; the good will sink to the bottom. This can only be depended upon at the time the fruit is first cut; if the seed has been dried and kept for any length of time, it will probably all swim, though it has not lost its vegetating properties.

1864. To Clean Cucumber and Melon Seed. Take all the seeds that sink in water and put them into a hair sieve; pour some warm water over them that has been heated to 90° or 95° Fahr., and then rub the seeds about in the sieve. The warm water will divest them of the glutinous matter, and it may be easily rubbed off them through the sieve, after which they may be laid to dry. Cucumber and melon seeds will vegetate after they have been kept for years.

1865. To Kill Moss on Lawns. Water the lawn with a weak solution of ammoniacal liquor (*see No.* 1854); 1 gallon of this liquor is sufficient to mix with 4 gallons of water, and should be put on with a rose water-pot. It will cause the grass to look brown afterwards for a while, but it will become green again. Another way is to procure some very fine siftings of coal-ashes, and sow them all over the parts where moss abounds. It will only be requisite to sow them very thinly, and if done just before a shower of rain, so much the better, as the rain will wash it in; this will kill the moss without injuring the grass. The presence of moss indicates that the soil is exhausted, and a top-dressing of nitrate of soda or soot will be found beneficial. If the grass is made to thrive, it will always choke the moss. (*See No.* 1876.)

1866. To Kill Moss on Meadow Land. The mossy parts of the meadow should be well manured with good well-rotted stable dung in the autumn; and, if practicable, the grass should be fed off the following spring with sheep. Nitrate of soda sown on the mossy parts of the field will also kill the moss, and is an excellent manure for the grass; but this should not be sown at the rate of more than 1½ cwt. per acre.

1867. To Kill Docks, Dandelions, etc. Cut the tops off in the spring or summer time, and pour some gas-tar, or sprinkle some salt on the wound. Either of these will kill the root, by eating to the very extremity.

1868. To Destroy Burdocks. Cut close to the ground with a sharp hoe, and apply a few drops of kerosene. The plant so treated will never appear again.

1869. To Prevent the Growth of Weeds in Garden Walks. A weak solution of carbolic acid applied with a watering-pot to garden walks will be an effectual mode of preventing the growth of weeds. The solution should not be stronger than 1 part pure carbolic acid to 1000 to 2000 parts water. Pure carbolic acid is a virulent poison. When applied in too strong a solution, larger plants may suffer; very weak solutions destroy only very small plants and animals, as parasites, miasma. Even flies and mosquitoes avoid its odor and may be driven away by it.

1870. To Destroy Thistles, Grass, and Weeds, in Gravel Walks. Sow coarse salt upon the plants; the thistles should be first cut to the ground, and the fresh roots be covered with the salt. The refuse article from the beef, pork, or salt fish barrel is quite good enough, and may be employed for this purpose.

1871. Cleanliness for Plants. Frequently the cause of the languidness of plants in rooms, arises from want of care in cleansing the leaves. Plants breathe by their leaves, which should be kept perfectly clean, otherwise their respiration is interfered with. The mere watering of the roots is not enough. Plants also perspire by their leaves, and any accumulation of dirt and dust retards this useful function. Plants also feed by their leaves, by absorbing the carbonic acid of the atmosphere; and, to speak familiarly, dirt destroys both their appetite and digestion. Let any one examine a sickly plant, long kept in a sitting-room, or draw a piece of white linen or leather over the surface of the leaves, and he will probably discover the cause of the plant's drooping.

1872. To Keep Cucumbers Fresh. When the cucumbers are at their best they should be cut, and laid in a box made just to fit them, and then bury the box in some dry sand, covering it over to the depth of a foot. There should not be any hay or moss put with them in the box, as it will cause them to turn yellow. If laid in the box without hay or moss, their color and bloom may be preserved for two weeks to look as fresh as the day they were cut. Melons may also be kept in the same way.

1873. To Cure Gumming in Fruit Trees. The place where the gum accumulates should be well washed and cleaned, and then stopped well up with a paste made of horse-dung, clay and tar. This will prevent the accumulation of the gum, and will assist the wound in healing over.

1874. To Prevent the Bottoms of Plant Sticks Rotting. Dip the bottoms of the plant sticks (as far as they are inserted into the ground) into hot asphalt three or four times, until the asphalt is the $\frac{1}{16}$ of an inch thickness on them; this will preserve them a long time. Those that have not the convenience of dipping them in asphalt, may substitute tar, and they will endure nearly as long as those that have been asphalted.

1875. To Destroy Weeds and Worms in Gravel Walks. Lay a coat of salt all over the walk, and then water it, using a rose water-pot; but this should not be done where there is a box edging, or it will kill that likewise. Where the edging is turf, slate, or tiles, there is nothing to fear.

1876. To Destroy Worms in Lawns, Grass Plots, etc. Mix at the rate of 10 pounds slacked lime to 30 gallons water; stir it up well together, and then let it stand for 2 or 3 days, in which time pour it off the sediment, and water the lawn with it by means of a rose water-pot; this will fetch the worms out on the top of the ground, and they will require to be swept up with a broom and carried away. The best time to do this is in damp weather, as the worms are then nearer the surface; and the lawn should be rolled the evening previous, which will not only assist in bringing the worms nearer the surface, but will fill up all the holes they have forsaken. The following night they will again open the holes in which they lie, and thereby afford the water greater facility to reach them the next day without wasting much by its soaking into forsaken holes. Diluted ammoniacal liquor will answer the same purpose, but it will make the grass look brown for some time afterwards. (*See No.* 1865.)

1877. Composition for Wounds on Rose-Bushes. Take 5 parts black pitch, 1 part each resin, tallow, and bees' wax; these should be mixed in a small pipkin, and dissolved over a slow fire. Apply it to the wounds with a brush, and it will heal them, as well as prevent their dying back.

1878. Bleeding in Vines. Work together 1 part calcined oyster-shells beaten to fine powder in a mortar, and 3 parts cheese, until they form a sort of paste. This mixture is to be forced into the pores of the wood where bleeding takes place, by means of the thumb and finger. A second application is sometimes necessary. (*See Nos.* 1880 *and* 1881.)

1879. Composition for Healing Wounds in Trees. Take 3 parts pounded chalk and 1 part common vegetable tar; mix thoroughly, and boil them with a low heat till the composition becomes of the consistency of bees' wax; it may be preserved for use in this state for any length of time. If chalk cannot conveniently be got, dry brick-dust may be substituted. After the broken or decayed limb has been sawed off, the whole of the saw-cut must be very carefully pared away, and the rough edges of the bark, in particular, must be made quite smooth; the doing of this properly is of great consequence; then lay on the above composition hot, about the thickness of half a dollar, over the wounded place, and over the edges of the surrounding bark; it should be spread with a hot trowel.

1880. New Grafting Wax. Melt 1 pound resin over a slow fire, add 1 ounce beef tallow, and stir with a perfectly dry stick or piece of wire. When somewhat cooled, add 1 table-spoonful spirits of turpentine, and lastly 5 ounces of 95 per cent. alcohol in small quantities, stirring the mass constantly. Should the alcohol cause it to lump, warm again until it melts. Keep in a bottle. Lay it on in a very thin coat with a brush. In a room of moderate temperature, the wax should be of the consistence of molasses. Should it prove thicker, thin it down with alcohol. It is always ready for use, is never affected by heat or cold, and heals up wounds hermetically.

1881. Grafting Wax. Take 4 ounces pitch, 4 ounces resin, 2 ounces hogs' lard, and 2 ounces bees' wax; put them all together into a pipkin, and dissolve them over a slow fire, and it will form an excellent grafting wax. By spreading some of this mixture on paper it makes the grafting paper. The French make very good grafting wax by mixing together equal quantities of bees' wax and resin, and adding as much tallow as will cause it to dissolve at a low temperature. For an application where limbs have been removed in pruning, nothing is better than coal tar.

1882. Grafting Clay. Take strong adhesive loam or clay, and knead it till of the consistency of soft soap. Take also some horse droppings, and rub through a riddle of half-inch mesh. Mix the two ingredients with fresh cow-dung, all in equal parts, to a uniform consistency. When grafting, the operator should have at hand some finely-riddled ashes, into which the hands should be dipped to prevent the clay from adhering, and enable him to give the whole a neat finish.

1883. To Propagate Marsh Plants. The best plan is by means of a stone trough 6 inches to a foot deep, and of any convenient length and breadth, with a hole for a tap at one corner. This is to be treated as a flower-pot; the bottom being covered with small stones, and the trough filled up with a compost of peat and light loam. The surface is then covered with any description of light moss that can be got, and watered till the whole is saturated to the brim.

1884. To Prepare Seeds for Exportation. Seeds intended for exportation should not be gathered until they have become perfectly ripe; they should then be laid in a stove, or exposed in the sun to dry, as getting them perfectly dry is the principal point. They may be packed in bags, papers, or boxes. If they are kept dry, they will bear a voyage of many months, without injury to their vegetating properties.

1885. To Prepare Nails for Wall-Trees. These should be of cast iron if they can be obtained. Before using, they should be heated red-hot, and then thrown into cold linseed oil. This gives them a varnish which preserves them from rusting, and prevents the mortar of the wall from sticking to them when they are drawn.

1886. Method of Covering a Bank of Earth With Grass. To cover a steep bank quickly with grass the following method is recommended by a German Horticultural Association: For each square rod to be planted, take ½ pound lawn grass seed, and mix it intimately and thoroughly with about 6 solid feet of good dry garden earth and loam. This is placed in a tub, and to it liquid manure, diluted with about ⅔ of water, is added and well stirred in, so as to bring the whole to the consistency of mortar. The slope is to be cleaned off and made perfectly smooth, and then well watered, after which the paste just mentioned is to be applied with a trowel, and made as even and thin as possible. Should it crack by exposure to the air, it is to be again watered and smoothed up day by day, until the grass makes its appearance, which will be in 1 or 2 weeks, and the whole declivity will soon be covered by a close carpet of green.

1887. Substitute for Glass for Hot-Houses. Apply, with a common painter's brush, boiled oil, or Canadian balsam, diluted with oil of turpentine, to the surface of white muslin previously stretched out and fastened in the position it is intended to occupy.

1888. To Preserve Potatoes and Other Roots. These are preserved in different ways, according to the object in view. Tuberous roots, as those of the dahlia, pæonia, tuberose, etc., intended to be planted in the succeeding spring, are preserved through the winter in dry earth, in a temperature rather under than above what is natural to them. So may the bulbous roots of commerce, as hyacinths, tulips, onions, etc.; but, for convenience, these are kept either loose, in cool dry shelves or lofts, or the finer sorts in papers, till the season of planting. Roots of all kinds may be preserved in an ice-house till the return of the natural crop. After stuffing the interstices with straw, and covering the surface of the ice with the same material, place on it boxes, casks, baskets, etc., and fill them with turnips, carrots, beet roots, and, in particular, potatoes. By the cold of the place, vegetation is so much suspended that all these articles may be thus kept fresh and uninjured till they give place to another crop in its natural season.

1889. To Dry Roots. They should be rubbed in water to get rid of the dirt and also some of the mucous substance that would otherwise render them mouldy; the larger are then to be cut, split, or peeled, but in most aromatic roots, the odor residing in the bark, they must not be peeled; they are then to be spread on sieves or hurdles, and dried in a heat of about 120° Fahr., either on the top of an oven, in a stove, or a steam closet, taking care to shake them occasionally, to change the surface exposed to the air. Thick and juicy roots, as rhubarb, briony, peony, water-lily, etc., are cut in slices, strung upon a thread, and hung in a heat of about 90° to 100°. Squills are scaled, threaded, and dried around the pipe of a stove, or in a hot closet. Rhubarb should be washed, to separate that mucous principle which would otherwise render it black and soft when powdered. Potatoes are cut in slices and dried.

1890. To Transplant Large Shade Trees. In the autumn, before the frost comes on, dig a trench around the tree and cut the roots, but not too near the tree. Remove the tree through the winter, when the ground is frozen. Raise it up with the frozen earth adhering to the roots. The whole mass is easily raised with levers on to a strong sled, and can then be drawn erect by means of oxen or horses. Trees from 20 to 30 feet high can be moved by this method, and they will grow in the spring.

1891. To Drain Land in Level Places, sink a well down to the first porous stratum. The water from the upper soil will flow readily into the well, especially if drain pipes or tiles be laid in its direction.

The Extermination of Vermin.

The following comparatively few receipts and directions for destroying, trapping and driving away insects and vermin of all kinds, have been selected as the most efficacious, from a large amount of information on the subject.

1893. To Catch Rats. Cover a common barrel with stiff, stout paper, tying the edge round the barrel; place a board so that the rats may have easy access to the top; sprinkle cheese parings or other feed for the rats on the paper for several days, until they begin to think that they have a right to their daily rations from this source; then place in the bottom of the barrel a piece of rock about 6 or 7 inches high, filling with water until only enough of it projects above the water for one rat to lodge upon. Now replace the paper, first cutting a cross in the middle, and the first rat that comes on the barrel top goes through into the water, and climbs on the rock. The paper comes back to its original position, and the second rat follows the first. Then begins a fight for the possession of the dry place on the stone, the noise of which attracts the others, who share the same fate.

1894. Rat Trap. Fill a barrel about half full of water. Make the cover ½ inch smaller all around than the inside of the top of the barrel. Drive a nail or wire on each side of the cover, exactly opposite each other, as a pivot, and fit in the barrel, so that a light weight will readily tip the cover. Put the bait on top, in a firm way, and place an empty barrel or box near by. This is a simple, but excellent trap.

1895. Bait to Catch Rats and Mice. If a drop of oil of rhodium be poured upon some bait in a common or wire spring trap, and the trap be set in an infested locality, in a short time the cage will be found occupied by vermin. Rats and mice possess a great liking for the oil, and will risk anything to obtain it.

1896. To Catch Muskrats. Take a steel trap with a single spring, set it 1½ inches under water, hang part of a sweet apple over the foot plate, and chain the trap to a stake or rush. The reason why the trap should be set under water is that when the muskrat sees the apple he will jump for it; when he comes down he gets his paws in the trap.

1897. Rat Poison. Recent experiments have shown that squills is an excellent poison for rats. The powder should be mixed with some fatty substance, and spread upon slices of bread. The pulp of onions is also good. Rats are very fond of either.

1898. To Drive Rats from a Building. Dissolve 2 ounces glue, 2 ounces tincture of assafœtida, and 2 ounces potash in water, and add ½ ounce phosphorus to the mixture. Then in a wire cage trap, baited with corn meal scented with oil of anise, catch two or three rats; if they are very numerous, more will be necessary; singe the hair partly off these in such a way as to hurt them as little as possible, then give them a slight coating with the above mixture, heated warm; let them loose into their holes, and there will be no more trouble with the rats for months to come. This mixture will last 2 years. Or: Take chloride of lime, and scatter it dry all around, and into their holes, and wherever they haunt, and they will leave at once.

1899. Phosphorus Paste for Vermin. Introduce 1 drachm phosphorus into a Florence flask, and pour over it 1 ounce rectified spirit. Immerse the flask in hot water until the phosphorus is melted, then put a well-fitting cork into the mouth of the flask, and shake briskly until cold. The phosphorus is now reduced to a finely divided state. This, after pouring off the spirit, is to be mixed in a mortar with 1½ ounces lard. 5 ounces flour and 1½ ounces brown sugar, previously mixed together, are now added, and the whole made into a paste with a little water. Cheese may be substituted for sugar when the paste is intended for rats or mice. There is said to be no danger whatever of spontaneous ignition, either during or after the preparation of this paste.

1900. An Insect Killer and Destroyer of Noxious Animals. The bisulphide of carbon seems to be useful in certain cases, when it may be applied without inconvenience to the human species. In an atmosphere containing $\frac{1}{20}$ of its volume, it has, according to Cloëz, a very rapid action on the animal organism, more rapidly, apparently, upon rats, rabbits, &c., than upon birds and frogs. Cloëz introduced 1¾ ounces bisulphide in a culvert, and found within 20 yards from the place some 40 dead rats.

1901. To Exterminate Cockroaches. Borax is one of the best of roach exterminators. There is something peculiar, either in the smell or touch of borax, which is certain death to them. They will flee in terror from it, and never appear again where it has once been placed. It has also the great advantage of being perfectly harmless to human beings; hence there is no danger from poisoning. The borax should be pulverized and sprinkled around the infested places.

1902. To Kill Cockroaches and Croton Bugs. Boil 1 ounce poke-root in 1 pint water until the strength is extracted; mix the decoction with molasses and spread it in plates in the kitchen or other apartments which are infested by these insects. Paris green sprinkled around the apartments will also exterminate them; but should be used with caution, as it is very poisonous.

1903. To Destroy Bed-bugs. Rub the bedsteads in the joints with equal parts of spirits of turpentine and kerosene oil, and the cracks of the surbase in rooms where there are many. Filling up all the cracks with hard soap is an excellent remedy. March and April are the months when bedsteads should be examined to kill all the eggs.

1904. To Destroy Bed-bugs in Papered Rooms. Clean the paint of the room thoroughly, and set in the centre of the room a dish containing 4 ounces of brimstone. Light it and close the room as tight as possible, stopping the keyhole of the door with paper, to keep the fumes of the brimstone in the room. Let it remain for 3 or 4 hours, then open the windows and air thoroughly. The brimstone will be found to have also bleached the paint if it was a yellowish white.

1905. Bed-bug Poison. Mix together 2 ounces camphor, 4 ounces spirits of turpentine, 1 ounce corrosive sublimate, and 1 pint alcohol.

1906. To Kill Bed-bugs. Benzine or gasoline will kill these pests as fast as they can be reached. By using a spring-bottom oiler, the fluid may be forced into cracks and crevices more thoroughly than by any other means. As this fluid is highly inflammable, contact with fire must be avoided. The room should be well aired and ventilated afterwards, until the gas passes away. (*See No.* 346.)

1907. To Exterminate Bed-bugs. Wash the article infested with a weak solution of chloride of zinc. This is an effectual banisher of these pests.

1908. Benzine as an Insect Destroyer. A mixture of 10 parts benzine, 5 parts soap, and 85 parts water, has been very successfully used to destroy the parasites which infest dogs. It has also been used with good results in veterinary practice, as an application in certain diseases of the skin; and thus diluted, is found to answer better than when used pure.

1909. To Disperse Black Ants. A few leaves of green wormwood, scattered among the haunts of these troublesome insects, is said to be effectual in dislodging them. (*See No.* 1848.)

1910. To Exterminate Red Ants. Grease a plate with lard, and set it where these insects abound. They prefer lard to anything else, and will forsake sugar for it. Place a few sticks around the plate for the ants to climb up on. Occasionally turn the plate bottom up over the fire, and the ants will fall in with the melting lard. Reset the plate, and in a short time you will catch them all. Powdered borax sprinkled around the infested places will exterminate both red and black ants. (*See No.* 1901.)

1911. To Kill Flies. Beat up the yolk of an egg with a table-spoonful each of molasses and black pepper finely ground; set it about in shallow plates and the flies will be rapidly killed. A sweetened infusion of quassia will answer the same purpose. Dissolve 1 drachm extract of quassia in a gill of water, mix with ½ gill molasses and pour the mixture on a flat dish where the flies have access. The quassia acts on them like a narcotic.

1912. Fly Poison. Boil ¼ ounce small chips of quassia in 1 pint water; add 4 ounces molasses. Flies drink this with avidity, and are soon destroyed by it.

1913. To Banish Fleas. The oil of pennyroyal will certainly drive them off; but a cheaper method, where the herb flourishes, is to dip dogs and cats into a decoction of it once a week. Mow the herb and scatter it in the beds of the pigs once a month. Where the herb cannot be got, the oil may be procured. In this case, saturate strings with it and tie them around the necks of dogs and cats, pour a little on the back and about the ears of hogs, which you can do while they are feeding, without touching them. By repeating these applications every 12 or 15 days, the fleas will leave the animals. Strings saturated with the oil of pennyroyal, and tied around the neck and tail of horses, will drive off lice; the strings should be saturated once a day.

1914. To Exterminate Fleas. Sprinkle chamomile flowers in the beds, and the fleas will leave.

1915. An Excellent Flea Trap. If you should happen to have the consciousness of having a flea about your person, you have but to introduce, before getting into bed, a piece of new flannel between the sheets, and you may depend on finding yourself forsaken for the flannel.

1916. To Prevent the Attacks of Gnats. The best preventive against gnats, as well as the best cure for their stings, is camphor.

1917. To Clear a Room of Mosquitoes. Take of gum camphor a piece about ⅛ the size of an egg, and evaporate it by placing it in a tin vessel, and holding it over a lamp or candle, taking care that it does not ignite. The smoke will soon fill the room, and expel the mosquitoes.

1918. To Keep Away Mosquitoes. Dip a piece of sponge or flannel in camphorated spirits, and make it fast to the top of the bedstead. A decoction of pennyroyal, or some of the bruised leaves, rubbed on the exposed parts, will effectually keep off those troublesome insects.

1919. To Destroy Vermin in Children's Heads. Take 1 ounce each vinegar and stavesacre, ½ ounce each honey and sulphur, and 2 ounces sweet oil. Make into a liniment, and rub the head with it. Insects are immediately suffocated by benzine. Those sometimes found in the heads of human beings are destroyed by it at once, without any inconvenient result being perceived. It has been employed very successfully in banishing the insects which infest domestic animals, etc. (*See No.* 1906.) The use of larkspur seed for the destruction of the insects infesting the human head is a time-honored application among country people—beds of the plant being cultivated frequently for the express purpose of furnishing material for the decoction. The efficiency of this remedy seems to depend on the presence of the alkaloid called delphine, which appears to be a poison especially fatal to insects.

1920. To Destroy Body Vermin. Apply stavesacre ointment or red precipitate.

1921. To Clean Canary Birds. These pretty things are often covered with lice, and may be effectually relieved of them by placing a clean white cloth over their cage at night. In the morning it will be covered with small red spots, so small as hardly to be seen, except by the aid of a glass; these are the lice, a source of great annoyance to the birds.

1922. Lice on Poultry. If infested with lice, damp the skin under the feathers with water, then sprinkle a little sulphur on the skin. If the bird be covered with insects or parasites, they will all disappear in the course of 12 hours.

1923. To Drive Flies from Stables. Scatter chloride of lime on a board in a stable, to remove all kinds of flies, but more especially biting flies. Sprinkling beds of vegetables with even a weak solution, effectually preserves them from caterpillars, slugs, &c. A paste of 1 part powdered chloride of lime and ½ part of some fatty matter placed in a narrow band round the trunk of the tree, prevents insects from creeping up it. Even rats, mice, cockroaches, and crickets flee from it.

1924. To Keep Flies from Horses. Procure a bunch of smartweed, and bruise it to cause the juice to exude. Rub the animal thoroughly with the bunch of bruised weed, especially on the legs, neck, and ears. Neither flies or other insects will trouble him for 24 hours. The process should be repeated every day. A very convenient way of using it, is to make a strong infusion by boiling the weed a few minutes in water. When cold it can be conveniently applied with a sponge or brush. Smartweed is found growing in every section of the country, usually on wet ground near highways.

Prepared Paper. Paper frequently requires some special preparation to fit it for many purposes for which it would be useless in its original state. The following methods of preparing paper will be found useful, and in some cases indispensable, for reference.

1926. To Make Transfer Paper. To prepare transfer paper, take some thin post or tissue paper, rub the surface well with black lead, vermilion, red chalk, or any coloring matter; wipe this preparation well off with a piece of clean rag, and it will be ready for use.

1927. To Make Tracing Paper with Petroleum. Saturate ordinary writing paper with petroleum by means of a brush, then wipe it off until it is dry. This makes a tracing paper equal to the manufactured article, for all ordinary purposes. It was discovered by Mr. Häusel, an architect at Neustadt.

1928. To Make Tracing Paper with Benzine. If paper be damped with pure and fresh distilled benzine, it at once assumes a transparency, and permits of the tracing being made, and of ink or water colors being used on its surface without any running. The paper resumes its opacity as the benzine evaporates, and if the drawing is not then completed, the requisite portion of the paper must be again damped with benzine. This new discovery of the properties of benzine will prove of great service to many branches of the art profession, in allowing the use of stiff paper where formerly only a slight tissue could be used.

1929. To Make Transparent or Tracing Paper. Dissolve a piece of white bees' wax, about the size of a walnut, in ½ pint spirits of turpentine; then having procured some very fine white, woven tissue paper, lay it on a clean board, and, with a soft brush dipped in this liquid, go over one side, and then turn it over and apply it to the other; hang it up in a place free from dust to dry. It will be ready for use in a few days. Some add a small quantity of resin, or use resin instead of wax.

1930. To Make Tracing Paper. Lay open a quire of paper, of large size, and apply with a clean sash tool a coat of varnish, made of equal parts of Canada balsam and oil of turpentine, to the upper surface of the first sheet, then hang it on a line, and repeat the operation on fresh sheets until the proper quantity is finished. If not sufficiently transparent, a second coat of varnish may be applied as soon as the first has become quite dry.

1931. Iridescent Paper. Boil in water, 8 parts nut-galls, 5 parts sulphate of iron, 4 parts each sal ammoniac and sulphate of indigo, and ⅛ part gum-arabic. Wash the paper in this decoction, and then expose it to ammonia.

1932. To Powder Glass. Heat the glass red-hot, throw it into cold water; dry, and pulverize it, coarse or fine as required, in an iron mortar. It is used to filter acids; is glued upon paper or muslin for polishing; also to rub down corns upon the feet, after they have well soaked and dried.

1933. To Make Glass Paper or Cloth. Powder the glass (that with a greenish hue is the best), and sift it through a very fine wire sieve, to separate the finest portion of the powder; this is for the smoothest degree of glass paper; sift the remainder successively through sieves gradually increasing in coarseness, to suit the different degrees of the glass paper required; keep the result of each sifting separate. Then smooth on both sides, with pumice stone, any good tough paper, and tack it on a board; a tolerably fine quality of muslin is far preferable to paper. If large sheets are used it is better to glue the edges on a frame (similar to a small quilting frame), and when dry, damp the paper or muslin and stretch it, in the same manner as the muslin is strained for sized roller blinds. Give the surface a coating of strong glue size, and *immediately* dust the glass of the required fineness equally and thoroughly all over, using the same sieve that was used to separate it from the rest of the powdered glass. When dry, throw off the surplus glass for future use.

1934. To Make Stone Paper. As, in cleaning wood-work, particularly pine and other soft woods, one process is sometimes found to answer better than another, we may describe the manner of manufacturing a stone paper, which, in some cases, will be preferred to sand paper, as it produces a good face, and is less liable to scratch the work. Having prepared the paper as described in the last receipt, take a quantity of powdered pumice stone, and sift it over the paper through a sieve of moderate fineness. When the surface has hardened, repeat the process till a tolerably thick coat has been formed upon the paper, which, when dry, will be fit for use.

1935. To Make Emery Paper or Cloth. This is prepared in precisely the same manner as glass paper (*see No.* 1933), using emery instead of glass.

1936. Phenyl Paper. This article would be useful for packing meat and other substances liable to decay. (*See No.* 1614.) It can be prepared by fusing 5 parts stearic acid at a gentle heat, mixing well with 2 parts carbolic acid and 5 parts melted paraffine, and stirring until the whole has become solid, and applying it to paper in the same manner as waxed paper is made. (*See No.* 1938.)

1937. Solvent for Silk, Paper, &c. The ammonio-oxide of copper is a solvent for silk, paper, and the cellular tissue of plants. If its action be limited to a few moments it converts the surfaces into a gelatinous mass.

1938. To Make Waxed Paper. Take cartridge or other paper, place it on a hot iron and rub it with bees' wax, or make a solution of the wax in turpentine, and apply it with a brush. It is generally prepared on a large scale by taking a quire of paper and opening it flat upon a table, and then going over it quickly with a very hot smoothing-iron, against which is held a piece of wax, which, melting, runs down upon the paper and is absorbed by it. A little practice will soon determine the amount of wax that should be melted off from time to time. When the upper sheet is saturated it is taken off, and the one below is treated in a similar manner. Any excess of wax applied in the first instance readily penetrates through to the lower layers. Useful for making water or air-proof pipes, for chemical experiments, also for tying up the necks of bottles, covering preserve jars, and for enveloping tobacco and other substances that require to be kept from the air, replacing generally tin-foil and similar substances.

1939. To Make Oiled Paper. Brush sheets of paper over with boiled oil, in which dissolve a little shellac carefully over a slow fire, and suspend them on a line until dry. Waterproof. Employed to tie over pots and jars, and to wrap up paste blacking, &c.

1940. Oiled Paper as a Substitute for Oiled Silk. Boiled linseed oil is reboiled with litharge, acetate of lead, sulphate of zinc, and burnt umber, an ounce of each to a gallon. The sheet of paper being laid on a square board, it is well covered with this mixture. The first sheet is covered on both sides; the second, placed on this, receives one coating; and so on to 20 or 50. Separate and hang up to dry.

1941. To Make Paper Fire and Waterproof. Take 26 ounces alum, and 4 ounces white soap, and dissolve them in a quart of water; into another vessel dissolve 2 ounces gum-arabic and 1 ounce glue, in the same quantity of water as the former, and add the two solutions together, which is now to be kept warm, and the paper intended to be made waterproof dipped into it, passed between rollers, and dried; or, without the use of rollers, the paper may be suspended until it has perfectly dripped, and then dried. The alum, soap, glue, and gum, form a kind of artificial leather, which protects the surface of the paper from the action of water, and also renders it somewhat fireproof. A second immersion makes it still better.

1942. To Make Fireproof Paper. Take a solution of alum and dip the paper into it, then throw it over a line to dry. This is suitable to all sorts of paper, whether plain or colored, as well as textile fabrics. Try a slip of the paper in the flame of a candle, and if not sufficiently prepared, dip and try it a second time.

1943. To Make Fireproof Paper. Newspapers may be rendered fireproof by dipping into a solution of soluble glass of 25° Baumé; next neutralizing the alkali by diluted muriatic acid of 10° Baumé while hot, and drying by the atmosphere. Fire cannot then destroy the texture of the paper.

1944. To Make Paper Waterproof. Melt in 10 pints hot water, 30 ounces glue, gelatine or size, and 3 ounces gum-arabic. In another 30 pints hot water, melt 20 ounces soap and 4 pounds alum; mix both liquids together in one pot. This constitutes composition No. 1. In another pot heat ½ gallon benzole and 1 gallon paraffine, and melt in it 24 ounces resin; let it boil until it attains a moderate degree of consistency. To these materials, resin, oil, and copal or mastic varnish may, in some cases, be added. This is composition No. 2. First dip the article to be waterproof into the composition No. 1 in a heated state, and then dry it. Next apply composition No. 2, in a cooled state, with a brush, or in any other convenient manner.

1945. Papier-Maché. A plastic material, formed of cuttings of white or brown paper, boiled in water, beaten to a paste in a mortar, and then mixed with a solution of gum-arabic in size, to give tenacity. It is variously manufactured by being pressed into oiled moulds, afterwards dried, covered with a mixture of size and lamp-black, or otherwise ornamented, and varnished.

1946. To Detect the Presence of Plaster in Paper. Calcine the paper in a close vessel, and dilute the residue with vinegar, in a silver spoon; if sulphuretted hydrogen is disengaged, which blackens the spoon, the presence of a sulphate (plaster) will be shown. This adulteration has lately become very common among the paper-makers, with the view of increasing the weight.

1947. To Detect Woody Fibre in Paper. The paper is touched with ordinary strong nitric acid. If wood fibre is present the paper will be colored brown, especially on warming.

1948. Magic Copying Paper. To make black paper, take lamp-black mixed with cold lard. Red paper—Venetian red mixed with lard. Blue paper—Prussian blue mixed with lard. Green paper—chrome green mixed with lard. The above ingredients to be mixed to the consistency of thick paste, and applied to the paper with a rag. Then take a flannel rag, and rub until all the color ceases coming off. These sheets, alternated with writing paper and written on with a solid pen, produce 2 or 3 copies of a letter at once.

1949. Manifold Copying Process. This is a method patented by Mr. Underwood, of London, for taking copies of writing by pressure; by this means as many as twenty copies or more of a letter or other writing can be obtained.

The copying paper is prepared by being wetted with a solution of 200 grains of the yellow or neutral chromate of potash in 1 gallon of distilled water. This paper can be used immediately, or may be dried, and damped with water when required for use. The copying ink to be used for the original writing must be made by dissolving (in a water-bath) about 6 pounds pure extract of logwood in 1 gallon distilled water.

Damp 6 sheets of the prepared paper, and remove all superfluous moisture with good blotting paper, place the original writing on the upper sheet, and put in the copying-press for about half a minute; then remove the original and substitute in its place 6 more damp sheets of the paper, and press for a quarter of an hour. Then take the original again and lay it on the top of 5 more damped sheets of the paper, and press for about two minutes; finally remove the original, and in its place put 3 more sheets of the paper, then press for a quarter of an hour. This process will give twenty copies. If more than twenty copies are to be made, the writing of the original should, before the ink is quite dry, be dusted over with a powder composed of 5 parts extract of logwood, 1 part powdered gum-arabic, and 1 part powdered gum-tragacanth.

1950. Process for Copying Very Old Writings. Niepce St. Victor gives a new process for copying very old writings. Ordinary copying paper is used, but is wetted with a thin solution of glucose or honey instead of water. On coming out of the press the paper is exposed to strong ammonia, which brings out very clearly lines otherwise almost illegible.

1951. To Prepare Paper for Varnishing. To prevent the absorption of varnish, and injury to any color or design on the paper, it is necessary to first give it 2 or 3 coats of size. The best size for white or delicate colors is made by dissolving a little isinglass in boiling water, or by boiling some clean parchment cuttings until they form a clear solution; then strain through a piece of clean muslin. It may be applied with a clean soft paint-brush, the first coat, especially, very lightly. The best brush for this purpose is the kind used by varnishers for giving the finishing *flow* coats of varnish, wide, flat and soft; or, where there is much danger of injuring a design, and the paper article will allow of it, it is a good plan for the first coat, to pour the solution into a wide, flat dish, and pass the paper through it once, and back again, and then hang it up to dry. For less delicate purposes, a little light-colored glue, soaked over night in enough water to cover it, and then dissolved by heat, adding hot water enough to dilute it sufficiently, will make an excellent sizing.

1952. To Size Paper. The paper must be passed or steeped in a mixture of glue and alum water. For transparent or semi-transparent paper, a mixture of starch, or dextrine and alum.

1953. Albuminous Size. Beat up the white of an egg with twice its bulk of cold water, until well incorporated. Used as a varnish for leather binding and kid gloves; also to size drawing paper.

1954. Pounce. Powdered gum sandarac generally passes under this name; it is used to prepare parchment for writing on, and to prevent ink from spreading on paper after erasure. Powdered cuttle-fish bone is occasionally used in the same way. Packers rub the surface of porous and greasy wood with a pounce consisting of whiting or powdered resin, to make it bear the ink. The colored powders (usually ultramarine) used by pattern drawers, for sprinkling over pricked papers, are also called pounce.

1955. Lithographic Paper. In order to prevent the ink tracings or design from adhering to and sinking into the paper, which would render a perfect transfer to the stone impossible, the surface of the paper requires proper preparation.

1956. To Prepare Lithographic Paper. Lay on the paper 3 successive coats of sheep-foot jelly, 1 layer of cold white starch, and 1 layer of gamboge. The first layer is applied with a sponge dipped in a hot solution of the jelly, thinly, but very evenly, over the whole surface; the next 2 coats are laid on in succession, each previous coat being first allowed to dry. The layer of starch, and then the coat of gamboge, are each applied with a sponge in the same way as the jelly. When the paper is dry it must be smoothed by passing it through the lithographic press; the smoother it becomes, the better. The transfer of traces from the gamboge surface of paper thus prepared is perfect.

The gamboge must be dissolved the same day it is used, as it becomes oily by standing. The starch should be a day old, and the skin removed from its surface.

1957. Lithographic Paper. Take rather strong, unsized paper, and cover it with a varnish composed of 120 parts starch, 40 parts gum-arabic and 20 parts alum. Make a moderate paste of the starch by boiling, dissolve the gum and alum separately, and then mix all together. When well mixed, apply hot with a flat, smooth brush, to the leaves of paper. Then dry and smooth by passing under the scraper of the lithographic press.

1958. Bernard and Delarne's Lithographic Crayons. Melt 4 parts pure white wax over a slow fire; stir in by degrees 2 parts gum lac, broken into small pieces; next mix in 2 parts dried soap (made of tallow and soda), reduced to fine shavings; then stir in 1 part oil copal varnish into which 1 part lampblack has been previously ground. Continue to heat and stir until the paste has acquired a proper consistence, which can be ascertained by forming a crayon with it in a mould, and allowing it to become cold. The mould should be first wiped with a greased rag.

Lasteyrie adopts a somewhat different formula for his crayons: Dried white tallow soap, 6 parts; white wax, 6 parts; lampblack, 1 part. The soap and tallow are to be put into a small goblet and covered up. When the whole is thoroughly fused by heat, and no clots remain, the black is gradually sprinkled in with careful stirring.

1959. Rouget's Method of Preserving Pencil Drawings. This invention consists in fixing drawings, tracings, or sketches, by directly projecting on these latter any suitable adhesive liquid reduced to a fine spray, or in what is commonly called the atomized or pulverized state, by causing the liquid to pass rapidly under pressure through one or more capillary tubes or openings. By this method the defects of the transudation process are entirely done away with, besides which the operation is executed in less time, and may be performed at once by the artist without the slightest difficulty. For the fixing liquid, any colorless, or nearly colorless liquid, which allows of being atomized, and which, after becoming dry, causes the particles of the charcoal, or other drawing materials made use of, to adhere sufficiently firmly to the paper or other drawing surface, may serve for the purpose. Thus, for instance, a liquid which has given the most satisfactory results is obtained by adding to a solution of 3 ounces white sugar candy and 2 ounces white shellac, in about 2 pints spirits of wine, a decoction of about 1 ounce fucus crispus (Irish moss) in 1 pint distilled water.

1960. To Fix Pencil or Chalk Drawings. Lay the drawing on its face, stretch it tightly on a board with drawing pins, and give the back 2 or 3 coats of a solution of 5 parts isinglass, or gum-arabic, in 12 parts water, using a varnisher's flow brush, and allowing each coat to dry before laying on the next. When dry, turn the drawing over, face upwards, and give it 1 or 2 coats in the same manner. This will usually be sufficient to fix the drawing, but the addition of 1 or 2 coats of a solution of 4 parts Canada balsam, in 5 parts turpentine, will afford still further protection.

1961. To Fix Pencil or Crayon Drawings. A convenient method of fixing pencil or crayon drawings consists in moistening the back of the sheet with a solution of bleached shellac in alcohol, care being taken not to have the solution either too concentrated or too thin, but such as will flow readily on the paper, making it transparent when moist, and leaving no spots behind on evaporation. In this way the drawings will become permanently fixed, and may afterward be painted in water-colors so as to produce a very excellent effect.

1962. To Fix Pencil Drawings. A simple method, and sufficient for general purposes, is to put into a large flat dish, a mixture of equal parts milk and water. The back of the drawing should be floated over the surface of the milk and water once or twice, according to the thickness of the paper, sufficient to wet it through, but not enough to allow any of the liquid to run on the surface of the drawing. Pin it on a line to dry. Some prefer using pure milk.

1963. To Take Creases out of Drawing Paper or Engravings. Lay the paper or engraving, face downwards, on a sheet of smooth, unsized white paper; cover it with another sheet of the same, very slightly damped, and iron with a moderately warm flat iron.

1964. To Make Parchment Transparent. Soak a thin skin of parchment in a strong lye of wood ashes, often wringing it out till you find it becomes transparent; then strain it on a frame, and let it dry. This will be much improved if, after it is dry, it receives a coat, on both sides, of clear mastic varnish, diluted with spirits of turpentine.

1965. To Make Artificial Parchment. De la Rue's patent. Strong unsized paper is immersed for a few seconds in oil of vitriol, diluted with half its volume of water. It is then washed in pure water or weak ammonia water. It strongly resembles animal parchment, and is used for the same purposes. The acid solution must be exactly of the strength indicated, and not warmer than the surrounding atmosphere.

1966. To Paste Parchment Paper. Thick, smooth paper does not generally hold long when pasted together or on wood. This difficulty is easily overcome. If the surface of that part of the paper which is to be joined be first moistened with alcohol or brandy, and the glue or paste then be applied, the union will be perfect. A piece of very thin paper inserted between the surfaces of the parchment paper will also make a firm joint. Glue or paste should be used, as gum-arabic will not answer.

1967. New Method of Making Parchment Paper. An improved method of preparing this substance, consists in using the commercial oil of vitriol in an undiluted state. The paper is first passed through a solution of alum, and thoroughly dried, previous to its immersion, thus preventing any undue action of the corrosive principle of the vitriol. After the application of the acid, the paper is passed into a vat of water, and then through an alkaline bath, to be again washed. Written and printed paper may undergo this improved process without materially affecting the clearness and distinctness of the letters, and the paper retains all its qualities, even after being wetted several times in succession, while paper prepared in the usual manner loses, to a great extent, its pliancy, and becomes hard and stiff.

1968. Papyrine. Dip white unsized paper for ½ a minute in strong sulphuric acid, and afterwards in water containing a little ammonia. When dried it has the toughness and appearance of parchment.

1969. To Color Parchment. The only color given to parchment is green. Boil 8 parts cream of tartar and 30 parts crystallized verdigris, in 500 parts water; when this solution is cold, pour into it 4 parts nitric acid. Moisten the parchment with a brush, and then apply the above liquid evenly over its surface. The necessary surface finish is given with white of eggs, or mucilage of gum-arabic.

1970. Composition for Drawing Crayons. Take 6 parts shellac, 4 parts spirit of wine, 2 parts turpentine, 12 parts of coloring powder, such as Prussian blue, orpiment, white lead, vermilion, &c., and 12 parts clay. The clay must be thoroughly washed, passed through a hair sieve and dried; it is then well incorporated by trituration with the shellac (previously dissolved in the spirits of wine), the turpentine and the coloring pigment. The doughy mass is pressed in proper moulds so as to acquire the desired shape, and then dried by stove heat.

1971. Charcoal Crayons. Saw the finest-grained, softest, and blackest pieces of charcoal, into slips of the size required, put them into a pipkin of melted wax, and allow them to macerate over a slow fire for half an hour, then take them out and lay them on blotting-paper to dry. The above process may also be employed for red and black chalk. Drawings made with these crayons are very permanent, and if warmed slightly on the wrong side, the lines will adhere and become as durable as ink. These crayons may also be made by simply shaping the charcoal with a knife. Willow charcoal should be used for this purpose.

1972. To Clean Engravings. Secure the engraving with drawing pins on a smooth board, and cover it thinly with common salt, finely powdered; pour and squeeze lemon juice upon this salt, so as to dissolve a considerable portion of it. Now elevate one end of the board, that it may form an angle of about 45° with the horizon. Pour lastly on the engraving boiling water from a tea-kettle, until the salt and lemon juice be all washed off; the engraving will then appear perfectly clean, and free from stains. It must be dried gradually, on the same board, or on some smooth surface. (*See Nos.* 411, *&c.*)

1973. To Clean Printed Paper and Picture Prints. Septimus Piesse gives the following receipt for that purpose: Fasten the paper to a board with button drawing pins, then wash it with water in which is dissolved an ounce of carbonate of ammonia to every pint of water. This do with care, employing a camel's-hair brush for the purpose. Then rinse the paper well with plenty of fresh water. When dry, repeat the same process for the reverse side of the paper. Now wet the paper with water made sour with white vinegar. Finally wet the paper with water containing a little bleaching powder, and again rinse with clean water; then dry it by exposure to air and sunshine. It will become white, excepting where printed. To stiffen the print give it a coat of parchment size. Most valuable prints have been thus restored.

1974. To Transfer Engravings to Paper. Place the engraving a few seconds over the vapor of iodine. Dip a slip of white paper in a weak solution of starch, and, when dry, in a weak solution of oil of vitriol. When again dry, lay a slip upon the engraving, and place both for a few minutes under a press. The engraving will be reproduced in all its delicacy and finish.

1975. To Print Engravings on Plaster. Cover the engraved plate with ink, and polish its surface in the usual way; then put a wall of paper round it, and, when completed, pour in some finely-powdered plaster of Paris mixed in water; jerk the plate repeatedly, to allow the air bubbles to fly upwards, and let it stand 1 hour; then take the cast off the plate, and a very perfect impression will be the result.

1976. Hydrographic Paper. This is a name given to paper so prepared, that, when written upon with water, or some other colorless fluid, instead of ink, the characters will become visible.

1977. To Write Black Characters with Water. Thoroughly dry and reduce to a very fine powder a mixture of 4 parts nut-galls, and 1 part calcined sulphate of iron; rub it over the surface of the paper, then forcing it into the pores by powerful pressure; brush off the loose portion, and a pen dipped in water will write black.

1978. To Write Blue Characters with Water. Prepare the paper with a mixture of sesquisulphate of iron and ferrocyanide of potassium, by the same method as the last receipt. Write with water as before, and the characters will appear blue.

1979. To Produce Brown Writing with Water. Instead of the sulphate of iron in the last receipt, use sulphate of copper; and characters written with water will be reddish-brown.

1980. To Write Blue with a Colorless Fluid. Wet the paper with a solution of ferrocyanide of potassium, and dry it again; write on it with a pen dipped in a solution of sesquisulphate of iron, and the writing will be blue.

Ivory, Alabaster, &c.

The folllowing receipts relate to the manipulation of ivory, bone, alabaster, meerschaum, horn, tortoise-shell, pearl, and marble.

1982. To Color or Dye Ivory or Bone. With regard to dyeing ivory, it may in general be observed, that the colors penetrate better before the surface is polished than afterwards. Should any dark spots appear, they may be cleared up by rubbing them with chalk; after which the ivory should be dyed once more, to produce a perfect uniformity of shade. On taking it out of the boiling hot dye bath, it should be plunged immediately into cold water, to prevent the chance of fissures being caused by the heat. Ivory may be dyed by any of the ordinary methods employed for woolens, after being freed from dirt and grease; but more quickly as follows:

1983. To Dye Ivory Black. The ivory, being well washed in an alkaline lye, is steeped in a *weak neutral solution* of nitrate of silver, and then exposed to the light, or dried and dipped into a *weak* solution of hydrosulphuret of ammonia.

1984. To Dye Ivory Deep Black. A still finer and deeper black may be obtained by boiling the ivory for some time in a strained decoction of logwood, and then steeping it in a solution of red sulphate, or red acetate of iron.

1985. To Dye Ivory Red. Make an infusion of cochineal in water of ammonia, then immerse the pieces therein, having previously soaked them for a few minutes in water *very slightly acidulated* with aquafortis.

1986. Fine Red Dye for Ivory. A beautiful red color may be imparted to ivory thus: Take 4 parts, by weight, picric acid, and dissolve in 250 parts boiling water; add, after cooling, 8 parts liquid ammonia. Dissolve also 2 parts crystallized fuchsine (magenta) in 45 parts alcohol, dilute with 375 parts hot water, and next add 50 parts ammonia. As soon as the red color of the magenta solution has disappeared, the two solutions are mixed together. Ivory and bone should be placed in very weak nitric or hydrochloric acids before being immersed in the ammoniacal liquid; wood cannot be dyed by this liquid unless it has been previously painted over with paste made from flour. When to the ammoniacal liquid some gelatine solution be added, it may serve as a red ink which does not attack steel pens. By varying the proportions of the magenta and picric acid, the tints obtained may be varied from a bluish red to a bright orange-red. The colors do not appear until the ammonia is evaporated.

1987. To Dye Ivory Blue. Steep it in a weak solution of sulphate of indigo which has been nearly neutralized with salt of tartar; or in a solution of Prussian blue. A still better plan is to steep in the dyer's green indigo vat; or, insert the ivory for 15 to 20 minutes in diluted muriatic acid (½ ounce of acid for 1 pound of water, having the taste of a good vinegar), and from this acidulated water transfer the ivory into a more or less concentrated solution of indigo-carmine (soluble indigo), and keep it in that solution until the ivory has assumed a uniform blue color; then dry and polish.

1988. To Dye Ivory Purple. Steep in a weak *neutral* solution of terchloride of gold, and then expose it to the light. Or, soak the ivory in a solution of sal ammoniac into 4 times its weight of nitrous acid.

1989. To Dye Ivory Green. Dissolve verdigris in vinegar, and steep the pieces therein for a short time, observing to use a glass or stoneware vessel; or in a solution of verdigris, 2 parts, and sal ammoniac, 1 part, in soft water; or, dye the ivory blue by the third receipt for that purpose, and then insert in a solution of picric acid, as prescribed for the dark lemon color. (*See No.* 1991.)

1990. To Dye Ivory Yellow. Steep the ivory in a bath of neutral chromate of potash, and afterwards in a boiling solution of acetate of lead.

Or: Steep the pieces for 24 hours in a solution of sugar of lead, then take them out, and when dry, immerse them in a solution of chromate of potassa.

Or: Dissolve as much of the best orpiment in water of ammonia or hartshorn as it will take up, then steep the pieces therein for some hours; lastly, take them out and dry them, when they will turn yellow.

1991. To Dye Ivory Dark Lemon. Dissolve ¼ ounce picric acid in ½ ounce boiling water. Dilute ⅛ ounce strong sulphuric acid with ¼ ounce hot water, by pouring the acid gradually into the water. Insert the ivory in the acidulated water, turn it around repeatedly, in order to admit the acid to all parts, remove the ivory from the fluid and dry it. Then insert the dried ivory in the boiling solution of picric acid, turn it also around, and leave it in the solution until all parts appear of a uniform yellow color. Then remove it from the solution of picric acid, dry, and polish the ivory with soap water and finely levigated chalk. After the polishing the ivory possesses a permanent dark lemon-yellow color.

1992. To Dye Ivory Violet. Dye red, and afterwards blue; or place the ivory in a highly-diluted solution of tin, and boil in the logwood bath.

1993. Aniline Dyes for Ivory. Any of these colors give a fine and permanent color to ivory by immersion.

1994. To Make Ivory Flexible. Ivory is rendered flexible by immersion in a solution of pure phosphoric acid (specific gravity 1.13) until it loses, or partially loses its opacity, when it is washed in clean cold water, and dried. In this state it is as flexible as leather, but gradually hardens by exposure to dry air. Immersion in hot water, however, restores its softness and pliancy. The following method may also be employed: Put the ivory to soak in 3 ounces nitric acid mixed with 15 ounces water. In 3 or 4 days the ivory will be soft.

1995. To Dye Ivory when Softened. If it is desired to dye ivory when thus softened, dissolve, in spirits of wine, such color as may be desired to use. When the spirits of wine is sufficiently tinged with the color, plunge in the ivory, and leave it there till it is dyed to suit.

1996. To Harden Ivory. To harden ivory after it has been softened, wrap it up in a sheet of white paper, cover it with dry, decrepitated salt, and lay it by for 24 hours, when it will be restored to its original hardness.

1997. To Bleach Ivory. Ivory is whitened or bleached by rubbing it with finely powdered pumice-stone and water, and exposing it to the sun whilst still moist, under a glass shade, to prevent desiccation and the occurrence of cracks; observing to repeat the process until a proper effect is produced. Ivory may also be bleached by immersion for a short time in water holding a *little* sulphurous acid, chloride of lime, or chlorine in solution; or by exposure to the fumes of burning sulphur, largely diluted with air. In many cases where, as in piano keys, the ivory cannot be removed, the polishing process will be found partially successful.

1998. To Restore Yellow Ivory to its Original Whiteness. A thin lime-paste is prepared in a pot, and heated over a stove; the ivory is placed in this and left until white, when it is taken out, dried, and polished.

1999. To Bleach Articles made of Ivory. This process is recommended by Dr. J. Artus. The objects made of this substance are first placed into a solution containing 11½ ounces carbonate of soda in crystals, and 45⅝ ounces water. After having been left in this fluid for 2 days, the ivory objects are well washed in pure water, and then immersed into a solution composed of 17 ounces sulphite of soda, and 45½ ounces water, and kept therein for 5 or 6 days, after which time there is added to the liquid, yet containing the ivory objects, 1 ounce hydrochloric acid diluted with 5½ ounces water. After the acid has been added, the vessel (glass or porcelain) containing the liquid and ivory should be covered and left standing for from 24 to 36 hours, after which time the ivory is taken out, washed in clean water, and dried. The quantities of ingredients herein specified suffice for 22½ ounces of ivory,

2000. To Polish Ivory. If ivory be polished with putty-powder and water, by means of a rubber made of hat, it will in a short time produce a fine gloss. Or, set the ivory in the turner's wheel, and, after having worked it, take some rushes and pumice-stone, mix a subtle powder with water, and rub till it becomes perfectly smooth; then heat it by turning it over a piece of linen or sheepskin, and when hot rub it with a little whitening diluted with olive oil; then rub it with a little dry whitening alone, and finally with a piece of soft white rag, and the ivory will look remarkably white.

2001. Fluid for Marking Ivory. Take nitrate of silver, 2 parts; nitric acid, 1 part; water, 7 parts; mix.

2002. Etching Fluid for Ivory. Take of diluted sulphuric acid and diluted muriatic acid, equal parts. Mix.

2003. Etching Varnish for Ivory. White wax, 2 parts; tears of mastic, 2 parts. Mix.

2004. To Etch on Ivory. Cover the ivory to be etched with a thin coating of bees' wax, then trace the figure you desire to present through the wax. Pour over it a strong solution of nitrate of silver. Let it remain a sufficient length of time, then remove it, with the wax, by washing in warm water. The design will be left in dark lines on the ivory.

2005. To Gild Ivory. Immerse it in a solution of nitro-muriate of gold, and then, while yet damp, expose it to hydrogen gas. Wash it afterwards in clean water. Another plan of gilding ivory is by immersing it in a fresh solution of protosulphate of iron, and afterwards in a solution of chloride of gold.

2006. To Silver Ivory. Immerse the ivory in a weak solution of nitrate of silver, and let it remain till the solution has given it a deep yellow color; then take it out and immerse it in clear water, and expose it in the water to the rays of the sun. In about 3 hours the ivory acquires a black color; but the black surface, on being rubbed, soon becomes changed to a brilliant silver.

2007. To Clean Ivory Ornaments. When ivory ornaments get yellow or dusky-looking, wash them well in soap and water with a small brush, to clean the carvings, and place them, while wet, in full sunshine; wet them for 2 or 3 days, several times a day, with soapy water, still keeping them in the sun; then wash them again, and they will be beautifully white.

2008. Bone for Ornamental Purposes is treated in a similar way to ivory, but less carefully, owing to its inferior value. The bones of living animals may be dyed by mixing madder with their food. The bones of young pigeons may thus be tinged of a rose color in 24 hours, and of a deep scarlet in 3 or 4 days; but the bones of adult animals take fully 2 weeks to acquire a rose color. The bones nearest the heart become tinged soonest. In the same way logwood and the extract of logwood will tinge the bones of young pigeons purple.

2009. Ivory Size or Jelly. The dust or shavings (ivory dust, ivory shavings) of the turner, form a beautiful size or jelly when boiled in water.

2010. Artificial Ivory for Photography. Tablets for photography are made by mingling finely pulverized sulphate of baryta or heavy spar with gelatine or albumen, compressing the product into sheets and drying it.

2011. Artificial Ivory. The process by which the most successful imitation of natural ivory is obtained appears to consist in dissolving either india-rubber or gutta-percha in chloroform, passing chlorine through the solution until it has acquired a light yellow tint, next washing well with alcohol, then adding, in fine powder, either sulphate of baryta, sulphate of lime, sulphate of lead, alumina, or chalk, in quantity proportioned to the desired density and tint, kneading well, and finally subjecting to heavy pressure. A very tough product, capable of taking a very high polish, is obtainable in this way.

2012. Horn. For practical purposes, the horns of the goat and sheep are preferred for their whiteness and transparency.

2013. To Dye Horn. Horn is dyed with the same dyes, and in the same manner, as ivory. (*See Nos.* 1982, *&c.*)

2014. To Prepare Horn. Horn is softened by sawing it into plates or sheets, and then exposing it to powerful pressure between hot iron plates. Before pressing, the pith has to be removed, and the texture softened, first by soaking for some days, and then boiling in water.

2015. To Unite Horn. The surfaces and edges of pieces of horn may be united or cemented together by softening by the heat of boiling water, then placing the parts in contact under strong pressure in a vise, and again exposing to the heat of boiling water.

2016. To Dye or Stain Horn Tortoise-shell Color. The horn to be dyed must be first pressed into proper plates, scales, or other flat form, and the following mixture prepared: Take of quicklime 2 parts, and litharge 1 part; temper them together to the consistence of a soft paste, with soap lye. Put this paste over all the parts of the horn, except such as are proper to be left transparent, in order to give it a near resemblance to the tortoise-shell. The horn must remain in this manner covered with the paste till it is thoroughly dry; when, the paste being brushed off, the horn will be found partly opaque and partly transparent, in the manner of tortoise-shell, and, when put over a foil of Dutch gold metal, will be scarcely distinguishable from it. It requires some degree of fancy and judgment to dispose of the paste in such a manner as to form a variety of transparent parts, of different magnitudes and figures, to look like the effect of nature; and it will be an improvement to add semi-transparent parts, which may be done by mixing whiting with some of the paste, to weaken its operation in particular places, by which spots of a reddish-brown will be produced, which, if properly interspersed, especially on the edges of the dark parts, will greatly increase the beauty of the work, and its similitude to real tortoise-shell.

2017. To Stain Horn in Imitation of Tortoise-shell. Mix an equal quantity of quicklime and red lead with strong soap lees, lay it on the horn with a small brush, in imitation of the mottle of tortoise-shell; when dry, repeat it two or three times.

2018. To Join or Weld Tortoise-shell or Horn. Provide a pair of pincers or tongs, constructed so as to reach 4 inches beyond the rivet; then have the tortoise-shell filed clean to a lap-joint, carefully observing that there is no grease about it; wet the joint with water, apply the pincers hot, following them with water, and the shell will be joined as if it were one piece. The heat must not be so great as to burn the shell, therefore try it first on a piece of white paper.

2019. To Polish Tortoise-Shell or Horn. Having scraped the work perfectly smooth and level, rub it with very fine sand-paper or Dutch rushes; repeat the rubbing with a bit of felt dipped in very finely powdered charcoal with water, and, lastly, with rotten-stone or putty-powder; and finish with a piece of soft wash-leather, damped with a little sweet oil; or, still better, rub it with subnitrate of bismuth by the palm of the hand.

2020. Alabaster. Oriental alabaster is a substance of a pure, semi-translucent whiteness, occasionally found variegated with undulating veins of yellow, red and brown. The common alabaster, usually met with in ornaments &c., is made of gypsum (plaster of Paris), and prepared so as to imitate the genuine. The following receipts are for the gypsum imitation, and not the real alabaster. By using any of the hardening processes, beautiful imitations of marble may be produced, but they require great care and skill.

2021. To Engrave or Etch on Imitation Alabaster. Cover every part of the surface, except those portions to be etched, with a solution of 1 part white wax in 4 parts oil of turpentine, thickening with a little finely powdered white lead; immerse the cast in water for from 20 to 50 hours, according to the effect desired. Then wash off the covering solution with oil of turpentine, and brush over carefully the etched parts with powdered gypsum (plaster of Paris). The etching is produced by the solvent action of the water on the gypsum.

2022. To Harden Alabaster. Expose the unpolished articles for from 12 to 24 hours to a heat about equal to that of a baker's oven; withdraw from the heat, and when considerably cooled, immerse them for from 2 to 5 minutes in pure river water. The operation may be repeated a second time, and 3 or 4 days are allowed to elapse before polishing them. A weak solution of alum in water may be substituted for the river water.

2023. To Dress Plaster of Paris with Wax in Imitation of Alabaster. Dip the cast or model, previously warmed, and suspended by a fine silken cord or wire into the purest white wax, melted in any suitable vessel. The operation should be repeated until the liquid wax begins to rest unabsorbed on the surface of the plaster, when the article must be placed aside (suspended) until the next day, when it may be polished with a clean brush. None but the hardest, purest, and whitest wax will do for the above purpose. That commonly sold is mixed with spermaceti, stearine, or tallow, and not unfrequently with Japanese wax and potato starch. (*See No.* 1582.)

2024. To Render Plaster Figures Durable. First thoroughly dry the plaster figure in a warm dry atmosphere; place it in a vessel and cover it with the clearest linseed oil, just warm. After 12 hours, take it out, drain, and let it dry in a place free from dust. When dry it will look like wax, and can be washed without injury.

2025. To Harden Plaster. Mix up the plaster of Paris with a weak solution of gum arabic (1 ounce to 1 pint of water); or, for common purposes, a weak solution of size. This not only renders the plaster harder, but gives the surface a pleasing smoothness.

2026. To Harden Imitation Alabaster with Alum. Suspend the article by a fine silken cord or wire in a strong and perfectly clear solution of alum, letting it remain until the alum crystallizes on the surface; then polish with a wet cloth.

2027. To Make Hard Plaster of Paris. Mix with weak alum water, instead of water, for casting; or, a solution of 1½ or 2 ounces of gum-arabic to the pint of water; or, for common purposes, a weak solution of size may be used.

2028. To Harden Plaster with Sulphate of Potassa. If equal parts of common calcined plaster of Paris and of sulphate of potassa be mixed together, they will harden in a moment with less than an equivalent weight of water; so much so, indeed, that the mixture cannot be poured out of the vessel. If, however, 1 part of each of the salts and 2 of water be used, they form a mass which cannot be poured out, and the surface of which will be found coated with a crust of sulphate of potash. The rapidity of hardening, therefore, can be made to vary with the percentage of water, the mass solidifying even if 6 parts of water be used.

2029. To Stain or Color Alabaster. This is effected by mixing with the water used for working the gypsum, any of the ordinary pigments or colored solutions that are not decomposed by contact with sulphate or carbonate of lime. A little sienna in very fine powder, or ground with water, imparts a good color for busts, medallions, &c. For rough and architectural purposes, the colors are commonly added to a solution of clear size, which is then made into a paste with plaster. In this manner colored stucco of great hardness and durability is produced. Objects formed from the solid alabaster may be stained in the same way, and with the same materials, as marble. (*See Nos.* 2036, *&c.*)

2030. To Polish Alabaster. The object, received in the rough state from the hands of the sculptor or turner, is rubbed with finely-powdered pumice-stone, or dried shave-grass (equisetum) and water, and afterwards with a paste formed of finely-powdered and sifted slacked lime and water. The rough polish thus produced is then brought up and finished off by friction with finely-powdered talc, or French chalk, until a satiny lustre is produced.

2031. To Prevent Expansion or Shrinkage in Casting Plaster. Use lime water instead of plain water to mix the plaster of Paris. ½ an ounce of sulphate of potassa dissolved in each quart of water will have the same effect, but weakens the plaster.

2032. To Make Artificial Marble for Paper Weights or other Fancy Articles. Soak plaster of Paris in a solution of alum; bake it in an oven, and then grind it to a powder. In using, mix it with water, and to produce the clouds and veins, stir in any dry color you wish; this will become very hard, and is susceptible of a high polish.

2033. To Polish Mother-of-Pearl. Go over it with pumice stone, finely powdered (first washed to separate the impurities and dirt), with which you may polish it very smooth; then apply putty powder as directed for ivory, and it will produce a fine gloss and a good color. (*See No.* 2000.)

2034. To Clean Alabaster. Soap well and wash with hot water. If stained, apply fuller's earth, pipe-clay, or whiting, for 3 or 4 hours, then wash off. If very dirty and stained, first wash with aquafortis diluted with water. Or: Take ground pumice stone of the finest quality, and mix it up with verjuice; let it stand for 2 hours, then dip in a sponge and rub the alabaster with it; wash with a linen cloth and fresh water, and dry with clean linen rags. Any kind of marble may be done in the same manner.

2035. To Polish Marble. With a piece of very fine sandstone, rub the slab backward and forward, using very fine sand and water, till the marble appears equally rough, and not in scratches; next use a finer stone and finer sand, till its surface appears equally gone over; then, with fine emery-powder and a piece of felt or old hat wrapped round a weight, rub it till all the marks left by the former process are worked out, and it appears with a comparative gloss on its surface. Afterward finish the polish with putty powder and fine clean rags. As soon as the face appears of a good gloss, do not put any more powder on the rags, but rub it well, and in a short time it will have a fine polish. Defects may also be brought up with tripoli, followed by putty powder; both being used along with water.

2036. To Dye or Stain Marble. Marble may be stained or dyed of various colors by applying their solutions to the stone made sufficiently hot to make the liquid just simmer on the surface. Success in the application of the colors requires considerable experience. By their skillful use a pleasing effect, both of color and grain, may be produced. The following are the substances usually employed for this purpose:

2037. Blue Stain for Marble. Tincture or solution of litmus, or an alkaline solution of indigo. (*See No.* 2036.)

2038. Brown Stain for Marble. Tincture of logwood. (*See No.* 2036.)

2039. Crimson Stain for Marble. A solution of alkanet root in oil of turpentine. (*See No.* 2036.)

2040. Flesh Color Stain for Marble. Wax tinged with alkanet root, and applied to the marble hot enough to melt it. (*See No.* 2036.)

2041. Gold Color Stain for Marble. A mixture of equal parts of white vitriol, sal ammoniac, and verdigris, all in fine powder, carefully applied. (*See No.* 2036.)

2042. Green Stain for Marble. An alkaline solution or tincture of sap green, or wax strongly colored with verdigris, or stain the stone first blue, and then yellow. (*See No.* 2036.)

2043. Red Stain for Marble. Tincture of dragon's blood, alkanet root, or cochineal. (*See No.* 2036.)

2044. Yellow Stain for Marble. Tincture of gamboge, turmeric, or saffron. (*See No.* 2036.)

2045. Acids Injurious to Marble. Marble being a carbonate of lime, and the two substances not having a very great affinity, care should be taken in the use of marble furniture and ornaments, as tables, mantels, statuary, etc. Acids of any kind will more or less affect marble, and they should not be allowed to touch it. The slabs on which acids are allowed to stand soon lose their polish, and are liable to a degree of disintegration which impairs their beauty. Fruits, sauces, vinegar, etc., should not be allowed to come in contact with a marble-topped table or shelf.

2046. To Polish Meerschaum. The dust of meerschaum is the best article for this purpose.

2047. Artificial Meerschaum. Artificial meerschaum may be made by immersing carbonate of magnesia in a warm solution of silicate of soda or potash for some time, or by precipitating from a solution of epsom salts by means of the silicates.

Pyrotechny.

This is the art of making fireworks. The three principal materials employed in this art are charcoal, saltpetre, and sulphur, combined with filings of iron, steel, copper or zinc, or with resin, camphor, lycopodium and other substances, to impart color, or to modify the effect and duration of the combustion. Gunpowder is used, either in grain, half crushed, or meal (finely ground), as circumstances may require. Iron filings give red and bright spots. Copper filings give a greenish tint to flame; those of zinc, a fine blue color; sulphuret of antimony gives a less greenish blue than the zinc, but with much smoke; amber, resin and common salt afford a yellow fire. Lycopodium burns with a rose color and a magnificent flame, &c.

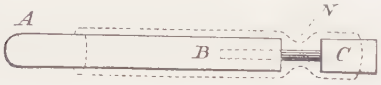
2049. The Leading Fireworks. The leading simple fireworks are rockets, Roman candles, flowerpots or gerbs, mines, and their adaptations or varieties; quick fires of different kinds and colors in cases, such as golden rain, spur fire, &c.; slow fires in cases and pots, as blue lights, Bengal lights, &c. These form the fundamental principles of all pyrotechnic display. The endless variety of their combinations in the shape of vertical and horizontal wheels and "set pieces," requires considerable fertility of invention and mechanical ingenuity, combined with a thorough practical knowledge of the nature of firework compositions, and the appropriate means of displaying them to the best advantage. The weights used in the following receipts are avoirdupois.

2050. To Make Plain Rockets. The cases are made of stout cartridge paper, rolled on a rod whose thickness is equal to the desired diameter of the bore. The rod is slightly tapering, to allow of its easier withdrawal after the case is rolled and pasted. The narrower end of the case is choked; that is, a neck is made in it, similar to the neck of a phial. (*See No.* 2053.) The composition (*see No.* 2054) is next rammed tightly into the case (*see No.* 2052), which is supported by a closely fitting mould during this operation, finishing with a small charge of gunpowder to explode when the rocket goes out. The top of the case is then stopped with clay and a conical cap fastened on, to decrease the resistance of the air in its upward flight; and the bottom or choked end of the case is furnished with priming and touch-paper. The whole is secured to the end of a willow stick, to direct its course through the air.

2051. To Make Display Rockets. Rockets whose discharge ends in display, are furnished with an extra case, called the pot, about ⅕ the length of the rocket; its inside diameter is the same as the outside diameter of the rocket case, over which it is glued firmly, and takes the place of the conical cap. The *garniture,* consisting of stars, serpents, &c., as the case may be (*see No.* 2055), is inserted in the pot and connected with the charge in the rocket case by a quick match. (*See No.* 2060.) The whole is finished with the clay and cap, the same as the head of a simple rocket.

2052. To Charge Rocket Cases. In charging rocket cases, in order to increase the rapidity of its discharge a wire is sometimes inserted through the centre of the charge, the rammer being constructed with a small bore through its length, to receive this wire when ramming the charge. This wire is withdrawn when the charge is complete, and the space it has left is filled with a quick match (*see No.* 2060), which thus sets fire to the entire charge at once. This central space is called the soul of the rocket, and the adoption of this arrangement is necessary for large rockets, especially those having heavy pots.

2053. To Choke Firework Cases. A short cylindrical piece of wood, of the same diameter as the thin end of the rod used for rolling a case, is furnished with a wire, the thickness of which must be the same as the desired bore of the choke. The end of the rod has a hole bored in it to receive this wire loosely. A is the rod on which the case is to be rolled; C the cap of the same diameter as the end of the rod, having the wire inserted firmly in its axis. The rod is bored, as the dotted lines at B denote, to receive the wire. The outside dotted lines indicate a case on the rod, choked at N. This is effected by stretching a piece of strong cord, a single turn of which is passed round the case at N, compressing it firmly and leaving a bore of the same size as the wire between the rod and the cap. In rolling a case to be choked, the paper should be used in pieces, each piece wide enough to make about 3 thicknesses when rolled over the rod, and the choking done after each piece is rolled. When finished, the rod is withdrawn from the mouth of the case, and the cap and wire from the other end.



2054. Composition for Rockets. For 2 ounce rockets:—Mix 54½ parts nitre (saltpetre), 18 parts sulphur, and 27¼ of charcoal, all in fine powder. Sift through lawn. For 4 ounce rockets:—64 parts nitre, 16 parts sulphur, and 20 parts charcoal. For 8 ounce to 1 pound rockets:—62¾ parts nitre, 15¾ parts sulphur, and 21½ parts charcoal. For rockets ¾ inch in diameter:—16 parts nitre, 4 parts sulphur, and 7 parts charcoal. For rockets 1½ inches in diameter use 1 part more nitre, and for still larger rockets, another additional part nitre. By using 1 part less charcoal, and adding respectively 3, 4, and 5 parts fine steel filings, the above are converted into *brilliant fires;* or, by using coarse iron filings, and still less charcoal, they become *Chinese fire.*

2055. Chinese Fire for Sky Rockets. If ¾ inch or under, nitre, 16 parts; charcoal, 4 parts; sulphur, 8 parts; cast-iron borings, 4 parts. Mix. Or: If over 1 inch and under 2 inches bore, nitre 16 parts; charcoal, 4 parts; sulphur, 4 parts; iron borings, 5 parts. Mix.

2056. Golden Rain. Mealed powder, 4 ounces; saltpetre, 1 pound; sulphur, 4 ounces; brass filings, 1 ounce; sawdust, 2¼ ounces; glass powder, 6 drachms.

2057. Silver Rain. Mealed powder, 2 ounces; saltpetre, 4 ounces; sulphur, 1 ounce; steel dust, ¾ ounce.

2058. Trailed Stars for Rockets and Roman Candles. Saltpetre, 4 ounces; sulphur, 6 ounces; sulphate of antimony, 2 ounces; resin, 4 ounces. With sparks. Mealed powder, 1 ounce; saltpetre, 1 ounce; camphor, 2 ounces. Other receipts for stars suitable for rocket garniture will be found under the head of "Colored Fires." (*See No.* 2065, *&c.*)

2059. To Prepare Touch Paper. Soak unglazed paper in a solution of nitre in vinegar or water. The stronger the solution, the faster will it burn. A good plan is to dip it in a weak solution, dry it, try it, and if it burns too slowly, make the solution stronger and dip it again to make it burn faster.

2060. To Make Quick Match. Quick match is made by immersing lamp-wick in a solution of saltpetre with meal powder, winding it on a frame, and afterwards dusting with meal powder. To 28 ounces cotton, take saltpetre, 1 pound; alcohol, 2 quarts; water, 3 quarts; solution of isinglass (1 ounce to the pint), 3 gallons; mealed powder, 10 pounds.

2061. Inextinguishable Match. Take 4 parts dry nitre, 2 gunpowder, 2 charcoal, and 1 sulphur, and mix them; then ram the compound into paper cases 9 inches in length and of the thickness of a common quill. When this composition is inflamed, rain will not extinguish it; the burning end of the match must be cut off to stay the fire.

2062. To Make Roman Candles. The cases for Roman candles are not choked, but well secured at the bottom with clay. A small charge of gunpowder is first introduced, then a star, followed by a charge of composition (*see No.* 2063); these are gently rammed down, and the same routine of gunpowder, star, and composition, is repeated until the case is full. Lastly, prime and close with touch paper. The stars are flat cylinders of a paste composition, cut to fit the bore of the case, and having a hole bored in their centre to allow the fire to pass through to the charge behind them. The stars which are nearest to the mouth of the case should fit a little tightly, and gradually a little more loosely as they are further from the mouth. The charges of powder behind them should also decrease by degrees as their position is further from the mouth of the case. It is also advisable to put a loose wad of one thickness of paper, with a hole in the centre, between each star and the gunpowder behind it.

2063. Composition for Roman Candles. Mix ½ pound meal-powder, 2½ pounds saltpetre, and ½ pound each sulphur and glass dust.

2064. Colored Stars may be made by using any of the receipts for colored fires, with a solution of isinglass, ½ ounce; camphor, ½ ounce; and alcohol, ¾ ounce. Make into cylindrical cakes of the requisite size, punch a hole in the centre of each, roll in gunpowder, and dry in the sun.

2065. Colored Fires. Great care is necessary in the preparation of these combustibles. The ingredients should be *separately* reduced to powder and sifted; then put into well-corked, wide-mouthed bottles until the time for mixing them for use. Colored fires deteriorate rapidly by keeping, and are nearly all dangerously inflammable; they should, therefore, be mixed as soon as possible before using them. The ingredients should be pure and perfectly dry; uniformly powdered, but not so fine as to be dusty. Nitrate of strontia, alum, carbonate of soda, and other crystals, should be gently heated in an iron pan until they lose their water of crystallization and crumble into dry powder. (*See Drying, No.* 3842.) Chlorate of potassa must be *very cautiously* handled, as it explodes by moderate friction. The requisite quantity of each ingredient should be weighed and placed on a clean sheet of white paper, and mixed lightly with a bone knife; they may then be more thoroughly mixed by sifting through a fine wire seive.

2066. Colored Fires for Illuminations. Pack the compounds lightly into small cups or pans.

2067. Colored Fires for Stars, &c. The compounds may be put into small pill-boxes, with a little priming and a quick match (*see No.* 2060) attached to each. If kept, they should be put where no damage can happen in case of their catching fire.

2068. To Make Colored Fires. The following receipts for the preparation of these effective aids in pyrotechnic and dramatic display, are among the very best that are known. These fires have in some theatres been assisted, if not superseded, by the calcium light; color being communicated by passing the rays of light through colored glass. The unpleasant smell of colored fires is avoided, and the effects can be prolonged at pleasure, instead of lasting merely a few moments.

2069. Blue Fire. Mix 2 parts realgar (red arsenic), 3 parts charcoal, 5 parts chlorate of potassa, 13 parts sulphur, and 77 parts nitrate of baryta.

2070. Bird's Blue Fire. 1 part charcoal, 1 part orpiment (yellow sulphuret of arsenic), 16 parts black sulphuret of antimony, 48 parts nitre, and 64 parts sulphur.

2071. Bengal, or Blue Signal Light, used at Sea. 1 part tersulphide of antimony, 2 parts sulphur, and 6 parts dry nitre. (*See No.* 2065.)

2072. Bengal Lights. Braunschweizer recommends the following mixtures as not producing injurious fumes: For red lights: 9 parts nitrate of strontia, 3 parts shellac, 1½ parts chlorate of potassa. For green: 9 parts nitrate of baryta, 3 parts of shellac, 1½ parts chlorate of potassa. For blue: 8 parts ammoniacal sulphate of copper, 6 parts chlorate of potassa, 1 part of shellac.

2073. Blue Fire for Stage Effect. 15 parts of sulphur, 15 parts sulphate of potassa, 15 parts ammonio-sulphate of copper, 27 parts nitre, and 28 parts chlorate of potassa. The blue is made darker or lighter by increasing or diminishing the potassa and copper ingredients. This is Marchand's preparation.

2074. Marsh's Blue Fire. Mix 7 parts sulphate of copper, 24 sulphur, and 69 parts chlorate of potassa.

2075. Marsh's Crimson Fire for Pots. Mix 17 parts chlorate of potassa, 23 willow charcoal, 90 parts sulphur, and 270 parts nitrate of strontia.

2076. Marsh's Crimson Fire for Stars and Boxes. Mix 17 parts charcoal, 22 parts sulphuret of antimony, 69 chlorate of potassa, 72 parts sulphur, and 220 parts nitrate of strontia.

2077. Marchand's Purple Crimson Fire. Mix 16 parts sulphur, 23 parts dry chalk, 61 parts chlorate of potassa.

2078. Green Fire for Ghost Scenes. Equal parts charcoal and nitrate of baryta.

2079. Brilliant Green Fire. A magnificent green fire can be prepared by mixing 8 parts chlorate of thallium, 2 parts calomel, and 1 part resin.

2080. Green Fire. Take 2 parts metallic arsenic, 3 parts charcoal, 5 parts chlorate of potassa, 13 parts sulphur, 77 parts nitrate of baryta. This is a beautiful fire, particularly when burnt before a reflector of glass or metal.

2081. Marchand's Green Fire. Mix 10 parts boracic acid, 17 sulphur, and 73 parts chlorate of potassa.

2082. Green Fire for Theatrical Tableaux. Take 18 parts chlorate of potassa, 22 parts sulphur, 60 parts nitrate of baryta.

2083. Light Green Fire. Mix 16 parts sulphur, 24 carbonate of baryta, 60 parts chlorate of potassa.

2084. Green Fire for Pots or Stars. Take 7 parts charcoal, 7 sulphuret of arsenic, 42 parts sulphur, 93 parts chlorate of potassa, 250 parts nitrate of baryta.

2085. Lilac Fire for Pans. Take 6 parts black oxide of copper, 20 dry chalk, 25 parts sulphur, 49 parts chlorate of potassa.

2086. Lilac Fire for Stars. Take 3 parts black oxide of copper, 22 parts dried chalk, 25 parts sulphur, 50 chlorate of potassa.

2087. Red Fire. Mix 16 parts sulphur, 23 parts carbonate of strontia, 61 parts chlorate of potassa.

2088. Red Fire for Stage Effect. Mix 20 parts chlorate of potassa, 24 sulphur, 56 parts nitrate of strontia.

2089. Orange Red Fire. Take 14 parts sulphur, 34 chalk, 52 parts chlorate of potassa.

2090. Purple Red Fire. Sulphur, 16 parts, 23 parts chalk, 61 parts chlorate of potassa.

2091. Purple Fire. Take 1 part each of lampblack, red arsenic, and nitre; 2 parts sulphur, 5 parts chlorate of potassa, and 16 parts fused nitrate of strontia.

2092. Pink Fire for the Stage. Mix 1 part charcoal, 20 chalk, 20 parts sulphur, 27 parts chlorate of potassa, 32 parts nitre.

2093. Rose Colored Fire. Take 16 parts sulphur, 23 dried chloride of calcium, 61 parts chlorate of potassa.

2094. Pale Violet Fire. Take 14 parts sulphur, 16 parts alum, 16 carbonate of potassa, 54 parts chlorate of potassa.

2095. Dark Violet Fire. Take 12 parts alum, 12 parts carbonate of potassa, 16 parts sulphur, 60 parts chlorate of potassa.

2096. White Fire for Theatres. Take 2 parts charcoal, 22 sulphur, 76 parts nitre.

2097. White Fire for Pans or Stars. Take 60 parts nitre, 20 parts sulphur, 10 black antimony, 4 parts powdered camphor, 6 parts meal powder.

2098. Marsh's White Fire for Pans. Take 25 parts gunpowder, 36 zinc filings, 46 parts sulphur, 93 parts nitre.

2099. Yellow Fire. Take 16 parts sulphur, 23 parts dried (*See No.* 2065) carbonate of soda, 61 chlorate of potassa.

2100. Marsh's Yellow Fire. Mix 12 parts charcoal, 149 parts dry (*see No.* 2065) nitrate of soda, 39 parts sulphur.

2101. Fire-eating Ghosts. Pour some strong warm spirits into a flat dish, sprinkle some salt into it, and set it on fire on a table in a perfectly dark room, taking care to protect the table from injury. Persons standing round the table will appear of a deathly pallor, and by eating raisins dipped in the burning spirit, will appear to eat fire. Shutting the mouth quickly on the burning raisins, extinguishes them instantly.

2102. Port Fire. The port fire used for cannon is composed of 3 parts nitre, 2 sulphur, and 1 gunpowder, well mixed and rammed into cases. These are also useful for igniting fireworks.

2103. Signal Lights. Such lights are generally composed of sulphur and nitre, with a small quantity of metallic sulphuret. Mix 600 grains nitre, 2 sulphur, and 100 yellow sulphuret of arsenic, and ram it into a conical paper case. When touched with a red-hot iron it deflagrates rapidly with a brilliant white light. The sulphuret of antimony may be substituted for that of arsenic.

2104. Indian White Fire Signal. Dry (*see No.* 2065) nitre, 24 parts; sulphur, 7 parts; powdered charcoal, 1; or instead of the charcoal, 2 parts red sulphuret of arsenic. Mix them intimately in an iron vessel, and ram the mixture into thick paper cylinders of about 3 inches in length by 1 in diameter. These are kept in a dry place, and when one is required to be used, it is set on end, and a piece of red-hot charcoal placed upon it.

2105. Iron Sand for Fireworks. Used to give corruscations in fireworks, is far better than iron or steel-filings. It is made by beating cast steel or iron into small pieces on an anvil. These are sifted into 4 sizes, the smallest for the smallest pieces, and vice versa. The corruscations produced by these are exceedingly brilliant. The sand should be kept in a dry place in a well-closed bottle, as any rust damages it. Fireworks containing it should not be made very long before using.

2106. Open Fires. The following article and receipts for open fires are by Professor Ferrum, and we quote them from the "American Druggists' Circular":

Among the many receipts for open fires, but few deserve to be recommended, and these have been selected. The white and red fires only show a clear, distinct color. The green is generally pale, and shows off only when burnt after a red. A pure blue is very difficult to obtain. The following should be observed as general rules: The ingredients for the fires are dried singly at a slightly elevated temperature, finely powdered, and preserved in well-stoppered bottles, until required for use The mixing of the ingredients is best performed on a sheet of paper by means of a card, and should be done very carefully so as to ensure a complete mixture. Sifting is in most cases admissible, while triturating in a mortar is above all to be avoided. After mixing, the powder is piled in small heaps in open vessels, for which purpose small flower-pots or flower-pot dishes are well adapted. On top of these several piles, some gunpowder is placed to facilitate the lighting. The vessels should be arranged in such a manner that the flame may illuminate the intended object without being seen by the spectators. The distribution of the material into a greater or less number of dishes is governed by circumstances. A great number of small flames from a certain quantity of mixture generally give a more intense, but so much shorter-lived light than the same quantity distributed in larger portions; beyond a certain limit, however, even that intensity is not materially heightened by a few more lights. If the fire is to continue for some time, it must further be considered that large quantities of the mixture form a correspondingly greater amount of slags, which greatly mar the effect. It is, therefore, best in such cases to burn off a number of small charges successively.

2107. White Fire. The following mixture we recommend as the very best for white lights, being unsurpassed in brilliancy and power by any other:

Saltpetre, 18 parts; sulphur, 10 parts; black sulphuret of antimony, 3 parts; burnt lime, 4 parts. The sulphur is used in the form of flowers previously dried; the lime is not to be slacked, but must be finely powdered; it must be fresh, and be powdered immediately before use. All other mixtures for white fires have either a bluish tinge or contain deleterious ingredients, which render them at least unsuitable for indoor use. Of the latter class we will mention only one: Saltpetre, 12 parts; sulphur, 4 parts; sulphite of tin, 1 part. Two other mixtures deserve mention, though not equal to the last:

I. Saltpetre, 48 parts; sulphur, 13¼ parts; sulphide of sodium, 7¼ parts; and

II. Saltpetre, 64 parts; sulphur, 21 parts; gunpowder, 15 parts.

2108. Blue Fire. The only mixture to be relied on, though the light is not purely blue, but bluish white, is the following: Saltpetre, 12 parts; sulphur, 4 parts; black sulphuret of antimony, 1 part.

2109. Red Fire. The following mixture is the best in use; its composition may be altered by various admixtures:

I. Nitrate of strontia, 13 parts; sulphur, 1 part; powder dust, 1 part. The latter ingredient is prepared from fine gunpowder, rubbed up carefully in a mortar and then sifted through a hair sieve. Another receipt is:

II. Nitrate of strontia, 24 parts; chlorate of potassa, 16 parts; stearine, 4 parts; powdered charcoal, 1 part. In using chlorate of potassa the precautions given in No. 2124 must be strictly observed, and all pounding and rubbing avoided.

III. Nitrate of strontia, 20 parts; chlorate of potassa, 4 parts; sulphur, 5 parts; black sulphuret of antimony, 2 parts; powdered charcoal, 1 part. Gives a very strong light. The nitrate of strontia for these fires, as the ingredients for all others, must be well, but carefully dried. (*See No.* 2065.)

2110. Yellow Fire. This color, which is very little used, is produced by the following mixture: Nitrate of soda, 48 parts; sulphur, 16 parts; black sulphuret of antimony, 4 parts; powdered charcoal, 1 part.

2111. Green Fires. The coloring ingredients for these lights are the salts of baryta. The color is generally not very deep.

I. Nitrate of baryta, 45 parts; sulphur, 10 parts; chlorate of potassa, 20 parts; calomel, 2 parts; lampblack, 1 part.

II. Nitrate of baryta, 60 parts; chlorate of potassa, 18 parts; sulphur, 22 parts.

III. Chlorate of baryta, 3 parts; sulphur, 1 part.

IV. Chlorate of baryta, 24 parts; stearin, 3 parts; sugar of milk, 1 part.

V. Chlorate of baryta, 3 parts; sugar of milk, 1 part.

2112. Colored Lights. We derive the receipts for these from the same source as the open fires. (*See No.* 2106.) Colored lights are formed by filling cylinders of thin writing paper of about an inch in diameter with the mixtures. The length of the cylinder determines the duration of the light. The mixtures may be moistened and pounded into the cylinder with a wooden rod; after drying, they will then be hard enough to allow of the removal of the paper, and may be further strengthened by being dipped in or painted over with mucilage of gum-arabic. The cylinders, when finished, are tied to the upper end of sticks fastened in the ground in a vertical position. The mixtures vary essentially from those used for colored fires.

2113. White Lights. Saltpetre, 4 parts; sulphur, 1 part; black sulphuret of antimony, 1 part.

2114. Yellow Lights. I. Black sulphuret of antimony, 2 parts; chlorate of potassa, 4 parts; sulphur, 2 parts; oxalate of soda, 1 part.

II. Saltpetre, 140 parts; sulphur, 45 parts; oxalate of soda, 30 parts; lampblack, 1 part.

2115. Green Lights. I. Chlorate of baryta, 2 parts; nitrate of baryta, 3 parts; sulphur, 1 part.

II. Chlorate of potassa, 20 parts; nitrate of baryta, 21 parts; sulphur, 11 parts.

2116. Red Lights. Nitrate of strontia, 25 parts; chlorate of potassa, 15 parts; sulphur, 13 parts; black sulphuret of antimony, 4 parts; mastich, 1 part.

2117. Pink Lights. Chlorate of potassa, 12 parts; saltpetre, 5 parts; sugar of milk, 4 parts; lycopodium, 1 part; oxalate of strontia, 1 part.

2118. Blue Lights. Chlorate of potassa, 3 parts; sulphur, 1 part; ammoniated copper, 1 part.

2119. Colored Lights without Sulphur—For Indoor Illuminations. These are used for the purpose of lighting up tableaux vivants, and for private theatricals.

2120. White Light. Chlorate of potassa, 12 parts; saltpetre, 4 parts; sugar of milk, 4 parts; lycopodium, 1 part; carbonate of baryta, 1 part.

2121. Yellow Light. Chlorate of potassa, 6 parts (or nitrate of baryta 10 parts); saltpetre, 6 parts; oxalate of soda, 5 parts; powdered shellac, 3 parts.

2122. Green Light. Only after yellow or red lights. Chlorate of potassa, 2 parts; nitrate of baryta, 1 part; sugar of milk, 1 part.

2123. Red Light. Nitrate of strontia, 12 parts; chlorate of potassa, 8 parts; sugar of milk, 1 part; stearine, 2 parts.

2124. Caution in the Use of Chlorate of Potassa. This substance should never be kept in admixture with any inflammable matter, especially sulphur or phosphorus, as they explode with terrific violence by the most trivial causes, and not unfrequently spontaneously. All pounding and rubbing must be avoided.

2125. Paper for Producing Flashes of Colored Light. Soak unsized paper for ten minutes in a mixture of 4 parts, by measure, oil of vitriol, and 5 parts strong fuming nitric acid; wash out thoroughly in warm distilled water, and dry it thoroughly at a gentle heat. The paper thus prepared is similar in its properties to gun cotton, and a small pellet of it, lighted at one point at a flame, and then thrown into the air, will produce a brilliant flash, and leave no perceptible ash. The color is given by saturating the gun-paper in the one of the solutions given below, and then drying it.

A solution of chlorate of strontium makes the flash a bright crimson. Chlorate of barium, green. Nitrate of potassium, violet. Chlorate of copper, blue. Any one of the foregoing chlorates may be prepared by mixing a warm solution of the corresponding chloride with an equivalent quantity of a warm solution of chlorate of potassa; the precipitate formed will be chloride of potassium, and the clear liquid, poured off, will be the desired chlorate, to be used for saturating the gun-paper.

2126. Japanese Matches. Lampblack, 5 parts; sulphur, 11 parts; gunpowder, from 26 to 30 parts, this last proportion varying with the quality of the powder. Grind very fine, and make the material into a paste with alcohol; form it into dice, with a knife or spatula, about ¼ inch square; let them dry rather gradually on a warm mantel-piece, not too near a fire. When dry, fix one of the little squares in a small cleft made at the end of a stalk of broom-corn. Light the material at a candle, hold the stem downward, and await the result. After the first blazing off, a ball of molten lava will form, from which the curious corruscations will soon appear.

2127. Japanese Firework Mixture. Finely pulverized nitrate of potassa, 70 parts; washed flowers of sulphur, 30 parts; powdered lycopodium, 12 parts; best and very light lampblack, 8 parts. From 1½ to 2 grains of this powder are sufficient for use packed in strips of suitable paper.

2128. Colored Flames. The flame of alcohol may be colored by mixing certain salts with the spirit. A green color is given by muriate of copper, or boracic acid. Red, by nitrate of strontian, nitrate of iron, or nitrate of lime. Yellow, by nitrate of soda, &c.

2129. Greek Fire. True Greek fire is simply a solid, highly combustible composition, consisting of sulphur and phosphorus dissolved in the bisulphide of carbon, to which occasionally some mineral oil is added, with the view of increasing its incendiary powers. When the liquid is thrown on any surface exposed to the air the solvent evaporates, leaving a film of the phosphorus or sulphide of phosphorus, which then inflames spontaneously. The proper mode of extinguishing such a fire is to throw damp sand, ashes, sawdust, lime, or any powder, wet sacking or carpeting, in short, any material which will exclude the air from the fire. No attempt should be made to remove the covering for some time after the flame has been extinguished. The place should afterward be thoroughly washed by a powerful jet of water forced upon it.

Explosives. This is a general term for all substances which explode with violence. Some of these, as gunpowder, gun-cotton, &c., explode by being brought into contact with fire. Others, to which the term of *Fulminates* is applied, explode with violence by slight heat, friction, or concussion.

2131. Fulminating Antimony. Grind well together 100 parts of dried tartar emetic, and 3 parts of lampblack, or charcoal powder; then take a crucible capable of holding 3 ounces of water, and having ground its edge smooth, and rubbed the inside with powdered charcoal, ¾ fill it with the above mixture, cover it with a layer of charcoal powder, and lute on the cover. Expose it for 3 hours to a strong heat in a reverberatory furnace, and, when taken out, let it stand to cool for 6 or 7 hours before removing its contents, to prevent an explosion. The crucible being now opened, the contents must be hastily transferred, without breaking, to a wide-mouthed stoppered phial, when, after some time, it will crumble down into a powder of itself. Or: Triturate together, very carefully, 100 parts antimony, 75 parts carburetted (roasted to blackness) cream of tartar, and 12 parts lampblack; preserve it in phials. When the above processes are properly conducted, the resulting powders fulminate violently on contact with water. It is to the presence of the very inflammable metal potassium that they owe this property. Another compound, made with 60 parts of carburetted cream of tartar, 120 bismuth, and 1 of nitre, treated as above, contains an alloy very rich in potassium. A piece the size of a pea introduced into a mass of gunpowder explodes it on being thrown into water.

2132. Fulminating Gold. Dissolve gold in aqua regia (made by dissolving 4 ounces sal ammoniac in 12 or 16 ounces nitric acid), and precipitate with a solution of carbonate of potassa. Fulminating gold should be made in very small quantities at a time, to avoid risk, as without great care it explodes with extreme violence. This is caused by the slightest friction or sudden increase of heat. Its fulminating property may be destroyed by boiling it in pearlash lye, or oil of vitriol; and by heating the powder after washing it in water, pure gold will be obtained.

2133. Fulminating Silver. Digest oxide of silver (recently precipitated, and dried by pressure between bibulous paper) in concentrated liquor of ammonia for 12 or 15 hours, pour off the liquid, and cautiously dry the black powder in the air. The decanted ammonia, when gently heated, yields, on cooling, small crystals, which possess a still more formidable power of detonation, and will scarcely bear touching, even while under the liquid. This compound is exploded by the slightest friction or percussion, and should therefore be only made in very small quantities at a time, and handled with great caution. Its explosive powers are tremendous; in fact, it can hardly be handled with safety, even in the moist state. Many frightful accidents have happened from the spontaneous explosion of this substance. At most 1 or 2 grains can be exploded with safety at one time.

2134. Fulminating Mercury. Dissolve by a gentle heat 100 parts, by weight, of mercury in 100 parts nitric acid of specific gravity 1.4; and when the solution has acquired a temperature of 130° Fahr., slowly pour it through a glass funnel tube into 830 parts alcohol of specific gravity .830. As soon as the effervescence is over and white fumes cease to rise, filter it through double paper, wash with cold water, and dry by steam (not hotter than 212°) or hot water. This is the formula of Dr. Ure, and said to be the cheapest and safest. If parts by measure be adopted, the above proportions will be, for 100 parts, by measure, of mercury, 740 parts nitric acid, and 830 parts alcohol.

2135. Fulminating Copper. Digest copper, in powder or filings, with fulminate of mercury or of silver, and a little water. It forms soluble green crystals that explode with a green flame.

2136. Fulminating Powder. Powder *separately* 3 parts nitre, 2 parts dry (*see No.* 2065) carbonate of potash, and 1 flowers of sulphur; mix them together carefully. If 20 grains of this compound are slowly heated on a shovel over the fire, it melts and becomes brown, exploding with a loud report.

2137. New Explosive Compound. B. G. Amend has observed that glycerine mixed with crystallized permanganate of potassa in a mortar spontaneously deflagrates.

2138. Priming for Percussion Caps. To make this compound 100 grains of fulminating mercury are triturated with a wooden muller on marble, with 30 grains of water and 60 grains of gunpowder. This is sufficient for 400 caps. Dr. Ure recommends a solution of gum mastich in turpentine as a medium for attaching the fulminate to the cap.

2139. Percussion Pellets. Mix equal parts of the chlorate of potassa and sulphuret of antimony with liquid gum, so as to form a paste. When dry it may be formed into pellets, and used as percussion powder for guns. This composition, placed on the ends of splints dipped in sulphur, produces friction matches. This mixture may also be employed for percussion caps, only without the gum; the two substances, mixed together dry, are forced into the caps, and a drop of varnish deposited on the inside surface of each. A mixture of the fulminate of mercury, chlorate of potassa, and sulphur, however, is more commonly used for lining percussion caps.

2140. To Make Gunpowder. Pulverize separately, 76 parts nitrate of potassa, 11 sulphur, and 13 freshly burned charcoal, and mix them with a little water, so as to form a cake when rolled out on a board. This is then dried on a clean sheet of paper placed in a warm situation, and afterwards crumbled into grains. It will form unglazed gunpowder. The pulverized ingredients, thoroughly mixed, without the addition of any water, constitute what is called *meal powder;* this may also be made by pulverizing grained gunpowder very cautiously in a mortar, or with a muller. (*See Porphyrization, No.* 25.)

2141. To Prepare Gun-Cotton. The simplest way consists in immersing, for a few seconds, well-carded cotton in a mixture of equal parts, by volume, of oil of vitriol of specific gravity 1.845, and nitric acid of specific gravity of 1.500. The cotton, when well saturated, is to be removed and squeezed to repel the excess of acid, and then well washed in clean cold water, until the water no longer reddens litmus paper. It is then dried at a heat not exceeding 212°. A lower temperature is still safer. The cotton thus prepared explodes well, but does not dissolve easily in ether. Under *Collodion* will be found other preparations of Gun-Cotton.

2142. Nitro-glycerine. This is an oily, colorless liquid, with a specific gravity of 1.60. It has no smell, but a taste which at first is sweet, but soon becomes pungent, like pepper; is soluble in ether and methylic alcohol, but not in water, but the presence of water diminishes the risk of explosion. It begins to evaporate at 365° Fahr. It has been found that pure nitro-glycerine, dropped upon a thoroughly red hot iron, assumes a spheroidal state and flashes off into vapor in the same way as gunpowder; but if the iron is not red hot, only hot enough to cause the nitro-glycerine to boil suddenly, a frightful explosion takes place. The explosion of a single drop in this manner will cause serious damage. This dangerous compound requires most careful handling, a slight shock sometimes exploding it.

2143. To Prepare Nitro-glycerine. Mix 100 parts fuming nitric acid at 50° Baumé with 200 parts sulphuric acid; when cool, add 38 parts glycerine slowly, allowing it to trickle down the sides of the vessel. The glycerine will remain on the surface for hours without mixing. Stir the glycerine and acids with a glass rod for 10 seconds, pour it into 20 times its volume of water, and the nitro-glycerine will be instantly precipitated to the extent of 76 parts, or double the amount of glycerine employed. It must be repeatedly washed with water, and then saturated with bicarbonate of soda or lime.

2144. Blasting Powders. Neither fresh nor salt water has any injurious effect on blasting powders; they need only to be dried to regain their explosive character. Their emitting but little smoke renders them useful in underground operations, and their explosive force is eight times that of gunpowder. They explode with extreme facility, either by contact with a strong acid, a slight elevation of temperature, or the slightest friction. In preparing them, therefore, excessive precaution is necessary, especially in mixing the ingredients. A straw, slightly wetted with oil of vitriol, applied to a small heap of the powder, will cause instantaneous explosion.

2145. To Make Blasting Powder. Reduce *separately* to powder, 2 parts chlorate of potassa and 1 part red sulphuret of arsenic; mix very lightly together. Or:—Powder separately, 5 parts chlorate of potassa, 2 parts red sulphuret of arsenic, and 1 part ferrocyanide of potassium (prussiate of potassa); mix carefully. Or:—Mix carefully, as before, after having separately reduced to powder, equal parts chlorate of potassa and ferrocyanide of potassium.

2146. Parlor or Congreve Matches. Dissolve 16 parts gum-arabic in the least possible quantity of water, and mix with it 9 parts phosphorus in powder (*see No.* 2696); then add 14 parts nitre (saltpetre), and 16 parts of either vermilion (red sulphuret of mercury), or binoxide (black oxide) of manganese, and form the whole into a paste. Dip the matches into this paste, and then let them dry. When quite dry they are to be dipped into a very dilute copal or lac varnish, and again dried; by this means they are less likely to suffer from damp weather.

2147. Cheap Parlor Matches. A cheaper paste for dipping may be made by soaking 6 parts glue for 24 hours in a little water, and liquefied by rubbing in a heated mortar; 4 parts phosphorus are next added at a heat not exceeding 150° Fahr.; then add 10 parts finely powdered saltpetre; and lastly 5 parts red lead and 2 parts smalts are mixed in, the whole being formed into a uniform paste. The matches are dipped, dried, varnished, and dried again, as before.

2148. To Make Matches Without Sulphur. To obviate the use of sulphur for igniting the wood of the match, the ends of the matches are first slightly charred by rubbing them against a red hot iron plate, and then dipped into as much white wax, melted in a suitable vessel, as will cover the bottom about ⅛ inch in depth. Or they may be dipped into camphorated spirit. Or into a solution of 1 ounce Venice turpentine and ½ ounce camphor, in ¼ pint oil of turpentine, with a little gum-benzoin and cascarilla by way of perfume. After any of the above preparations the matches are ready for dipping in the phosphorus paste.

2149. Substitute for Lucifer Matches. The dangers arising from the universal adoption of the common lucifer match have induced chemists to seek a substitute for it. M. Peltzer has recently proposed a compound which is obtained in the shape of a violet powder, by mixing together equal volumes of solutions of sulphate of copper, one of which is supersaturated with ammonia, and the other with hyposulphite of soda. A mixture of chlorate of potash and the above powder will catch fire by percussion or rubbing; it burns like gunpowder, and leaves a black residue. M. Viederbold proposes a mixture of hyposulphite of lead, or baryta, or chlorate of potash, for matches without phosphorus. The only inconvenience of this compound is that it attracts moisture too easily.

2150. Mixtures for Matches. For sulphur dips: Phosphorus, 3 parts; glue, 6 parts; sand, 1 part; incorporated below 100° Fahr., with 10 parts of water. Or, phosphorus, 5 parts; fine sand, 4 parts; red ochre, 1 part (or, ultramarine), ½ part; gum-arabic, 5 parts, in 6 pints of water (or, 4 parts of glue in 9 parts of water). For stearine dips: Phosphorus, 3 parts; brown oxide of lead, 2 parts; turpentine, ½ part, softened in 3 parts water. Instead of the brown oxide, 2 parts of red lead stirred up with ½ part of nitric acid may be used.

Cements and Uniting Bodies.

In the preparation of cements and all substances intended to produce close adhesion, whether in a semi-fluid or pasty state, freedom from dirt and grease is a most essential and necessary condition. Quite as much depends upon the manner in which a cement is applied as upon the cement itself. The best cement that ever was compounded would prove entirely worthless if improperly applied. The preparations given below will be found to answer every reasonable demand; and if properly prepared and used strictly according to the directions laid down, will seldom fail to form a union as strong, if not stronger than the substances joined. The first point that demands attention, is to bring the cement itself into intimate contact with the surface to be united. This end is best reached, when using hot cements, by making the edges to be joined at least as hot as the cement when applied, or as nearly so as can be done without injury to the substance; in some cases it is even preferable to melt the cement on the heated edges. Another very important point is to use as little cement as possible. When the surfaces are separated by a large mass of cement, we have to depend upon the strength of the cement itself, and not upon its adhesion to the surfaces which it is used to join; and, in general, cements are comparatively brittle. Sealing-wax is a very good agent for uniting metal to glass or stone, provided the masses to be united are made so hot as to fuse the cement; but if the cement is applied to them while they are cold, it will not stick at all. This fact is well known to venders of cement for uniting earthenware. By heating two pieces, so that they will fuse shellac, they are able to join them so that they will rather break at any other part than along the line of union. But although people constantly see the operation performed, and buy liberally of the cement, it will be found in nine cases out of ten the cement proves worthless in their hands, simply because they do not know how to use it. They are afraid to heat a delicate glass or porcelain vessel to a sufficient degree, and they are apt to use too much of the material, and the result is a failure; the cement is consequently deemed good for nothing. The great obstacles to the junction of any two surfaces are air and dirt. The former is universally present, the latter is due to accident or carelessness. All surfaces are covered with a thin adhering layer of air which it is difficult to remove, and unless this is displaced, the cement cannot adhere to the surface to which it is applied, simply because it cannot come into contact with it. The most efficient agent in displacing this adhering air is heat. Metals warmed to a point a little above 200° become instantly and completely wet when immersed in water. Hence, for cements that are used in a fused condition, heat is the most efficient means of bringing them in contact with the surfaces to which they are to be applied. In the case of glue, the adhesion is best attained by moderate pressure and friction.

2152. **Armenian or Jeweler's Cement.** The following is a receipt for a strong cement used by some oriental nations, for the purpose of attaching precious stones to metallic surfaces: Take 6 pieces of gum mastic, the size of a pea, and dissolve them in the smallest possible quantity of 95 per cent. alcohol. Soften some isinglass in water (though none of the water must be used), and saturate strong brandy with it till you have 2 ounces of glue; then rub in 2 small pieces of gum ammoniac. Mix the two preparations at a heat. Keep well stoppered. Set the bottle in hot water before using. It is said by the Turks that this preparation will unite two metallic surfaces, even of polished steel.

2153. **Keller's Armenian Cement for Glass, China, &c.** Soak 2 drachms cut isinglass in 2 ounces water for 24 hours; boil down to 1 ounce; add 1 ounce spirit of wine, and strain through linen. Mix this, while hot, with a solution of 1 drachm mastic in 1 ounce rectified spirit, and triturate thoroughly with ½ drachm powdered gum ammoniac.

2154. **Ure's Diamond Cement.** Take 1 ounce isinglass and 6 ounces distilled water; boil down to 3 ounces; add 1½ ounces rectified spirit. Boil for 2 minutes, strain, and add, while hot, ½ ounce of a milky emulsion of ammoniac, and 5 drachms tincture of gum mastic.

2155. **Chinese Cement.** Take of orange shellac, bruised, 4 ounces; highly rectified spirit of wine, 3 ounces. Set the mixture in a warm place, frequently shaking it till the shellac is dissolved. Wood naphtha may be substituted for the spirit of wine, but the unpleasant smell of the naphtha is some objection.

2156. **To Mend Broken Glass.** A much better process for mending broken glass, china and earthenware with shellac, than heating them, is to dissolve the shellac in alcohol to about the consistence of molasses, and with a thin splinter of wood or pencil-brush touch the edges of the broken ware. In a short time it sets without any heating, which is often inconvenient. It will stand every contingency but a heat equal to boiling water.

2157. **To Mend Crockery Ware.** One of the strongest cements and easiest applied for this purpose is lime and the white of an egg. To use it, take a sufficient quantity of the egg to mend one article at a time, shave off a quantity of lime, and mix thoroughly. Apply quickly to the edges and place firmly together, when it will very soon become set and strong. Mix but a small quantity at once, as it hardens very soon, so that it cannot be used. Calcined plaster of Paris would answer the same purpose.

2158. **Badigeon.** A cement used by operatives and artists to fill up holes and cover defects in their work. Statuaries use a mixture of plaster and free-stone for this purpose; carpenters, a mixture of sawdust and glue, or of whiting and glue; coopers use a mixture of tallow and chalk. The same name is given to a stone colored mixture used for the fronts of houses, and said to be composed of wood-dust and lime slacked together, stone-powder, and a little umber or sienna, mixed up with alum water to the consistence of paint.

2159. **Japanese Cement.** Intimately mix the best powdered rice with a little cold water, then gradually add boiling water until a proper consistence is acquired, being particularly careful to keep it well stirred all the time; lastly, it must be boiled for one minute in a clean sauce-pan or earthen pipkin. This glue is beautifully white and almost transparent, for which reason it is well adapted for fancy paper work, which requires a strong and colorless cement.

2160. **Curd Cement.** Add ½ pint vinegar to ½ pint skimmed milk. Mix the curd with the whites of 5 eggs well beaten, and sufficient powdered quick-lime sifted in with constant stirring, so as to form a paste. It resists water, and a moderate degree of heat, and is useful for joining small pieces of marble or alabaster.

2161. To Make a Cement that will Resist Benzine and Petroleum. It has quite recently been discovered that gelatine mixed with glycerine yields a compound liquid when hot, but which solidifies on cooling, and forms a tough, elastic substance, having much the appearance and characteristics of India rubber. The two substances united form a mixture entirely and absolutely insoluble in petroleum or benzine, and the great problem of making casks impervious to these fluids is at once solved by brushing or painting them on the inside with the compound. This is also used for printers' rollers and for buffers of stamps, as benzine or petroleum will clean them when dirty in the most perfect manner and in an incredibly short space of time. Water must not be used with this compound.

2162. Cement to Resist Petroleum. A cement peculiarly adapted to stand petroleum or any of its distillates is made by boiling 3 parts resin with 1 caustic soda and 5 water. This forms a resin soap which is afterward mixed with half its weight of plaster of Paris, zinc white, white lead, or precipitated chalk. The plaster hardens in about 40 minutes.

2163. Cement for Aquaria. Mix 3 pounds well dried venetian red (finely powdered) with 1 pound oxide of iron, and add as much boiling oil as will reduce it to a stiff paste.

2164. Cement for Marine Aquaria. Take 10 parts by measure litharge, 10 parts plaster of Paris, 10 parts dry white sand, 1 part finely powdered resin, and mix them, when wanted for use, into a pretty stiff putty with boiled linseed oil. This will stick to wood, stone, metal, or glass, and hardens under water. It is also good for marine aquaria, as it resists the action of salt water. It is better not to use the tank until 3 days after it has been cemented.

2165. Water Cement. Manganese is found to be a valuable ingredient in water cements. 4 parts gray clay are to be mixed with 6 parts black oxide of manganese, and about 90 parts good lime stone reduced to fine powder, the whole to be calcined to expel the carbonic acid; when well calcined and cooled, to be worked into the consistence of a stiff paste, with 60 parts washed sand.

2166. Cement for Glass Syringes. Take resin, 2 parts; gutta percha, 1 part; melt together over a slow fire, apply hot, and trim with a hot knife.

2167. Quickly-Setting Rust Joint Cement. Make into a paste with water 1 part by weight sal ammoniac in powder, 2 parts flower of sulphur, and 80 parts iron borings.

2168. Slowly-Setting Rust Joint Cement. Make into a paste with water, 2 parts sal ammoniac, 1 part flower of sulphur, and 200 parts iron borings. This cement is better than the last if the joint is not required for immediate use.

2169. Red Lead Cement for Face Joints. Mix 1 part each white and red lead with linseed oil to the proper consistence.

2170. Singer's Cement for Electrical Machines and Galvanic Troughs. Melt together 5 pounds resin, and 1 pound bees' wax, and stir in 1 pound red ochre (highly dried, and still warm), with 4 ounces Paris plaster, continuing the heat a little above 212° and stirring constantly till all frothing ceases. Or, (for troughs), resin, 6 pounds; dried red ochre, 1 pound; calcined plaster of Paris, ½ pound; linseed oil, ¼ pound.

2171. Cement for Rooms. M. Sarel, of Paris, has made an invention which is pronounced better than plaster of Paris for coating the walls and ceilings of rooms. A coat of oxide of zinc, mixed with size, made up like a wash, is first laid on, and over that a coat of chloride of zinc applied, prepared in the same way as the first wash. The oxide and chloride effect an immediate combination, and form a kind of cement, smooth and polished as glass, and possessing the advantages of oil paint without its disadvantages of smell.

2172. Coppersmith's or Blood Cement. Bullock's blood thickened with finely powdered quicklime makes a good cement to secure the edges and rivets of copper boilers, to mend leaks from joints, &c. It must be used as soon as mixed, as it rapidly gets hard. It is extremely cheap and very durable, and is suited for many purposes where a strong cement is required.

2173. Pew's Composition for Covering Buildings. Take the hardest and purest limestone (white marble is to be preferred), free from sand, clay, or other matter; calcine it in a reverberatory furnace, pulverize, and pass it through a sieve. 1 part, by weight, is to be mixed with 2 parts clay well baked and similarly pulverized, conducting the whole operation with great care. This forms the first powder. The second is to be made of 1 part calcined and pulverized gypsum, to which is added 2 parts clay, baked and pulverized. These two powders are to be combined, and intimately incorporated, so as to form a perfect mixture. When it is to be used, mix it with about a fourth part of its weight of water, added gradually, stirring the mass well the whole time, until it forms a thick paste, in which state it is to be spread like mortar upon the desired surface. It becomes in time as hard as stone, allows no moisture to penetrate, and is not cracked by heat. When well prepared it will last any length of time. When in its plastic or soft state, it may be colored of any desired tint.

2174. Hard Hydraulic Cement. A cement which is said to have been used with great success in covering terraces, lining basins, cementing stones, etc., resisting the filtration of water, and so hard that it scratches iron, is formed of 63 parts well-burned brick, and 7 parts litharge, pulverized and moistened with linseed oil. Moisten the surfaces to which it is to be applied.

2175. Universal Cement. Dissolve 2 ounces mastic in just enough 95 per cent. alcohol to effect a solution. Then soak 2 ounces isinglass, or fish-glue until it is thoroughly softened. Dissolve the isinglass in proof spirits sufficient to form a strong glue, and then add 1 ounce finely pulverized gum ammoniac. Warm the two mixtures together over a slow fire, and when they are thoroughly mixed, bottle and hermetically seal them. This cement becomes perfectly dry in 12 or 15 hours. When the cement is to be used, the bottle should be heated in a water bath to liquefy it; the fragments to be cemented should also be heated before joining them, and, as a matter of course, the surfaces well cleaned. Glass, crockery, &c., restored by the above cement, are as solid as before having been mended, and the seams are scarcely visible.

2176. To Cement Amber. Amber is joined or mended by smearing the surfaces with boiled linseed oil, and strongly pressing them together, at the same time holding them over a charcoal fire or heating them in any other way that will not injure the amber.

2177. To Cement Alabaster and Plaster. Ornaments of alabaster or plaster may be joined together by means of a little white of egg, thickened with finely-powdered quicklime, or by a mixture of newly-baked and finely-powdered plaster of Paris, mixed up with the least possible quantity of water.

2178. Mending Plaster Models. Wax and resin, or shellac varnish, is recommended for the above purpose. Dr. Chaim suggests the use of liquid silex. Wet the two surfaces with it, and allow a few moments to dry. It will be found very useful in cases of accident to a cast.

2179. Waterproof Mastic Cement. Mix together 1 part red lead to 5 parts ground lime, and 5 parts sharp sand, with boiled oil. Or: 1 part red lead to 5 whiting and 10 sharp sand mixed with boiled oil.

2180. Marble Workers' Cement. Flower of sulphur, 1 part; hydrochlorate of ammonia, 2 parts; iron filings, 16 parts. The above substances must be reduced to a powder, and securely preserved in closely stopped vessels. When the cement is to be employed, take 20 parts very fine iron filings, add 1 part of the above powder, mix them together with enough water to form a manageable paste. This paste solidifies in 20 days and becomes as hard as iron.

2181. Masons' Cement for Coating the Insides of Cisterns. Take equal parts of quicklime, pulverized baked bricks, and wood ashes. Thoroughly mix the above substances, and dilute with sufficient olive oil to form a manageable paste. This cement immediately hardens in the air, and never cracks beneath the water.

2182. Colored Cements. Professor Boettger prepares cement of different colors and great hardness by mixing various bases with soluble glass. Soluble soda glass of 33° Baumé is to be thoroughly stirred and mixed with fine chalk, and the coloring matter (*see* 12 *following receipts*) well incorporated. In the course of 6 or 8 hours a hard cement will set, which is capable of a great variety of uses. As soluble glass can be kept on hand in liquid form, and the chalk and coloring matters are permanent and cheap, the colored cements can be readily prepared when wanted, and the material can be kept in stock, ready for use, at but little expense. Boettger recommends the following coloring matters:

2183. Black Cement. Well sifted sulphide of antimony, mixed with soluble glass and chalk (*see No.* 2182), gives a black mass, which, after solidifying, can be polished or burnished with agate, and then possesses a fine metallic lustre.

2184. Grey-Black Cement. Fine iron dust, mixed as in No. 2182, gives a grey-black cement.

2185. Grey Cement. Zinc dust. This, used as in No. 2182, makes a grey mass, exceedingly hard, which, on polishing, exhibits a brilliant metallic lustre of zinc, so that broken or defective zinc castings may be mended and restored by a cement that might be called a cold zinc casting. It adheres firmly to metal, stone, and wood.

2186. Bright Green Cement. Carbonate of copper, used according to No. 2182, gives a bright green cement.

2187. Dark Green Cement. Sesquioxide of chromium, mixed as in No. 2182, gives a dark green cement.

2188. Blue Cement. Thénard's blue, used as in No. 2182, makes a blue cement.

2189. Yellow Cement. Litharge, with soluble glass, &c., see No. 2182, gives a yellow cement.

2190. Bright Red Cement. Cinnabar, used as directed in No. 2182, makes a bright red cement.

2191. Violet Red Cement. Carmine, used as in No. 2182, yields a violet red cement.

2192. White Cement. The soluble glass with fine chalk alone (*see No.* 2182) gives a white cement of great beauty and hardness.

2193. Black Cement. Sulphide of antimony and iron dust, in equal proportions, stirred in with soluble glass (*see No.* 2182), afford an exceedingly firm black cement.

2194. Dark Grey Cement. Zinc dust and iron in equal proportions, used as in No. 2182, yield a hard dark grey cement.

2195. Portland Cement. Portland cement is formed of clay and limestone, generally containing some silica, the properties of which may vary without injury to the cement. The proportion of clay may also vary from 19 to 25 per cent. without detriment. The only necessary condition for the formation of a good artificial Portland cement, is an intimate and homogeneous mixture of carbonate of lime and clay, the proportion of clay being as above stated. The materials are raised to a white heat in kilns of the proper form, so that they are almost vitrified. After the calcination all pulverulent and scorified portions are carefully picked out and thrown away. The remainder is then finely ground and becomes ready for use. The amount of water which enters into combination with it in mixing is about .366 by weight. It sets slowly, from 12 to 18 hours being required. Made into a thin solution like whitewash, this cement gives woodwork all the appearance of having been painted and sanded. Piles of stone may be set together with common mortar, and then the whole washed over with this cement, making it look like one immense rock of grey sandstone. For temporary use a flour-barrel may have the hoops nailed, and the inside washed with a little Portland cement, and it will do for a year or more to hold water. Boards nailed together, and washed with it, make good hot-water tanks. Its water-resisting properties make it useful for a variety of purposes.

2196. Mastic Cements, or Pierre Artificielle. Boettger says that these cements are mixtures of 100 parts each of sand, limestone, and litharge, with 7 parts linseed oil. These ingredients, carefully mixed and well worked together, will have the consistency of moist sand, and at first but little coherence. When pressed, however, the mixture gradually acquires the hardness of ordinary sandstone, and in six months time will emit sparks when struck with steel. The binding agents in such cements are the litharge and oil, the sand giving the body, and limestone or chalk filling up the interstices.

2197. Coarse Stuff for Plastering. Coarse stuff, or lime and hair, as it is sometimes called, is prepared in the same way as common mortar, with the addition of hair procured from the tanner, which must be well mixed with the mortar by means of a three-pronged rake, until the hair is equally distributed throughout the composition. The mortar should be first formed, and when the lime and sand have been thoroughly mixed, the hair should be added by degrees, and the whole so thoroughly united that the hair shall appear to be equally distributed throughout.

2198. Fine Stuff for Plastering. This is made by slacking lime with a small portion of water, after which sufficient water is added to give it the consistence of cream. It is then allowed to settle for some time, and the superfluous water is poured off, and the sediment suffered to remain till evaporation reduces it to a proper thickness for use. For some kinds of work it is necessary to add a small portion of hair.

2199. Stucco for Inside of Walls. This stucco consists of 3 parts fine stuff (*see No.* 2198) and 1 part fine washed sand. Those parts of interior walls which are intended to be painted are finished with this stucco. In using this material, great care must be taken that the surface be perfectly level, and to secure this it must be well worked with a floating tool or wooden trowel. This is done by sprinkling a little water occasionally on the stucco, and rubbing it in a circular direction with the float, till the surface has attained a high gloss. The durability of the work much depends upon how it is done, for if not thoroughly worked it is apt to crack.

2200. Gauge Stuff. This is chiefly used for mouldings and cornices which are run or formed with a wooden mould. It consists of about ⅕ plaster of Paris, mixed gradually with ⅘ fine stuff. (*See No.* 2198.) When the work is required to set very expeditiously, the proportion of plaster of Paris is increased. It is often necessary that the plaster to be used should have the property of setting immediately it is laid on, and in all such cases gauge stuff is used, and consequently it is extensively employed for cementing ornaments to walls or ceilings, as well as for casting the ornaments themselves.

2201. Higgins' Stucco. To 15 pounds best stone lime add 14 pounds bone ashes, finely powdered, and about 95 pounds clean, washed sand, quite dry, either coarse or fine, according to the nature of the work in hand. These ingredients must be intimately mixed, and kept from the air till wanted. When required for use, it must be mixed up into a proper consistence for working with lime water, and used as speedily as possible.

2202. Durable Composition for Ornaments. This is frequently used, instead of plaster of Paris, for the ornamental parts of buildings, as it is more durable, and becomes in time as hard as stone itself. It is of great use in the execution of the decorative parts of architecture, and also in the finishings of picture frames, being a cheaper method than carving, by nearly 80 per cent. It is made as follows: 2 pounds best whitening, 1 pound glue, and ½ pound linseed oil are heated together, the composition being continually stirred until the different substances are thoroughly incorporated. Let the compound cool, and then lay it on a stone covered with powdered whitening, and heat it well until it becomes of a tough and firm consistence. It may then be put by for use, covered with wet cloths to keep it fresh. When wanted for use it must be cut into pieces adapted to the size of the mould, into which it is forced by a screw press. The ornament, or cornice, is fixed to the frame or wall with glue, or with white lead.

2203. Roman Cement. Calcine 3 parts of any ordinary clay, and mix it with 2 parts lime; grind it to powder, and calcine again. This makes a beautiful cement, improperly called Roman, since the preparation was entirely unknown to the Romans.

2204. New Plastic Material. A beautiful plastic substance can be prepared by mixing collodion with phosphate of lime. The phosphate should be pure, or the color of the compound will be unsatisfactory. On setting, the mass is found to be hard and susceptible of a very fine polish. The material can be used extensively, applied in modes that will suggest themselves to any intelligent artist, to high class decoration.

2205. Concrete. A compact mass, composed of pebbles, lime, and sand, employed in the foundations of buildings. The best proportions are 60 parts of coarse pebbles, 25 of rough sand, and 15 of lime; others recommend 80 parts pebbles, 40 parts river sand, and only 10 parts lime. The pebbles should not exceed about ½ pound each in weight. Abbé Moigno, in his valuable scientific journal, "Les Mondes," relates his personal experience with a concrete formed of fine wrought and cast iron filings and Portland cement. The Abbé states that a cement made thus is hard enough to resist any attempts to fracture it. As he states that the iron filings are to replace the sand usually put into the mixture, we presume that the relative quantities are to be similar.

2206. Concrete Floors and Walks. Compost for barn and kitchen floors:—After the ground on which the floor is intended to be made is leveled, let it be covered to the thickness of 3 or 4 inches with stones, broken small, and well rammed down; upon which let there be run, about 1½ inches above the stones, 1 part by measure calcined ferruginous marl, and 2 parts coarse sand and fine gravel, mixed to a thin consistence with water. Before this coating has become thoroughly set, lay upon it a coat of calcined marl, mixed with an equal part of fine sand, 1 to 1½ inches thick, leveled to an even surface. The addition of blood will render this compost harder. The calcined marl mentioned above is the

Portland cement of commerce. (*See No.* 2195.)

2207. Concrete Gravel Walk. Dig away the earth to the depth of about 5 inches, then lay a bottom of pebbles, ramming them well down with a paving rammer. Sweep them off as clean as possible with a broom, and cover the surface thinly with hot coal tar. Now put on a coat of smaller gravel (the first bed of pebbles should be as large as goose eggs), previously dipped in hot coal tar, drained, and rolled in coal ashes, with an intermixture of fine gravel, and roll it down as thoroughly as possible. Let the roller run slowly, and let a boy follow it with a hoe to scrape off all adhering gravel. Next put on a coat of fine gravel or sand, and coal tar, with some coal ashes, to complete the surface, and roll again as thoroughly as possible; the more rolling the better. It will take some weeks to harden, but makes a splendid hard surface which sheds water like a roof. Do not use too much tar. It is only necessary to use enough to make the ingredients cohere under pressure, and a little is better than too much. Such a surface will last in a farmyard a great while.

2208. Cheap Concrete Flooring. Mix 3 bushels coal ashes from a blacksmith's shop with 2 bushels gas lime, and then add sufficient gas tar to make a stiff mortar. If the ammoniacal liquor has been separated from the tar, its place must be supplied by adding water till the tar is thin enough for use. For stables and cattle sheds, the mortar can be laid down with a spade, and fine sharp sand or gravel sifted over it; then roll well, and you will have a good concrete floor. It will take a few days to get thoroughly hard, even in dry weather; but it will be a good piece of work, if carefully done. Autumn is the best time for laying this kind of pavement.

2209. Keene's Marble Cement. This is made of baked gypsum or plaster of Paris, steeped in a saturated solution of alum, and then recalcined and reduced to powder. For use, it is mixed with water, as ordinary plaster of Paris. This cement has been most extensively applied as a stucco; but the finer qualities (when colored by the simple process of infusing mineral colors in the water with which the cement powder is finally mixed for working), being susceptible of a high degree of polish, produce beautiful imitations of mosaic, and other inlaid marbles, scagliola, &c. The cement is not adapted to hydraulic purposes, nor for exposure to the weather, but has been used as a stucco for internal decorations, and from its extreme hardness is very durable. A pleasing tint is given to this cement by adding a little solution of green copperas to the alum liquor.

2210. Parker's Cement. This valuable cement is made of the nodules of indurated and slightly ferruginous marl, called by mineralogists septaria, and also of some other species of argillaceous limestone. These are burned in conical kilns, with pit coal, in a similar way to other limestone, care being taken to avoid the use of too much heat, as, if the pieces undergo the slightest degree of fusion, even on the surface, they will be unfit to form the cement. After being properly roasted, the calx is reduced to a very fine powder by grinding, and immediately packed in barrels, to keep it from the air and moisture. It is tempered with water to a proper consistence, and applied at once, as it soon hardens, and will not bear being again softened down with water. For foundations and cornices exposed to the weather, it is usually mixed with an equal quantity of clean angular sand; for use as a common mortar, with about twice as much sand; for coating walls exposed to cold and wet, the common proportions are 3 of sand to 2 of cement, and for walls exposed to extreme dryness or heat, about 2½ or 3 of sand to 1 of cement; for facing cistern work, water frontages, &c., nothing but cement and water should be employed. This cement, under the name of compo, or Roman cement, is much employed for facing houses, water-cisterns, setting the foundations of large edifices, &c. It is perhaps the best of all cements for stucco.

2211. Pollack's Cement for Iron and Stone. This cement takes some little time to dry, but turns almost as hard as stone, and is fire and water-proof. For mending cracks in stone or cast-iron ware, where iron filings cannot be had, it is invaluable. Take litharge and red lead, equal parts, mix thoroughly and make into a paste with concentrated glycerine to the consistency of soft putty; fill the crack and smear a thin layer on both sides of the casting so as to completely cover the fracture. This layer can be rubbed off if necessary when nearly dry by an old knife or chisel. M. Pollack has used it to fasten the different portions of a fly-wheel with great success; while, when placed between stones, and once hardened, it is easier to break the stone than the joint.

2212. Cement from Furnace Slag. Furnace slag can be made to furnish an excellent cement by selecting such portions of it as are readily dissolved in dilute hydrochloric acid. On subjecting it to the action of the acid, silica is thrown down, which is afterward to be washed, dried, and pulverized. One part of this is next to be mixed with 9 parts powdered slag and the necessary quantity of slacked lime. This matter soon hardens, and rivals the best cement in its durability.

2213. Zeiodite. This substance is made by mixing 20 to 30 parts roll sulphur with 24 parts powdered glue or pumice, which forms a mass as hard as stone that resists the action of water and the strongest acids. Prof. R. Boettger recommends it, therefore, for making water-tight and air-tight cells for galvanic batteries.

2214. Cement for Closing Cracks in Stoves, etc. A useful cement for closing up cracks in stove plates, stove doors, etc., is prepared by mixing finely-pulverized iron, such as can be procured at the druggists, with liquid water-glass, to a thick paste, and then coating the cracks with it. The hotter the fire then becomes, the more does the cement melt and combine with its metallic ingredients, and the more completely will the crack become closed.

2215. Cement for Fastening Iron to Stone. A cement for fastening iron to stone, which becomes nearly as hard as the stone itself, consists of 6 parts Portland cement, 1 part powdered lime, not slacked, 2 parts sand,

and 1 part slacked lime, mixed with water to the proper consistency, the stone and iron both being previously dampened. In 48 hours it will have set firmly.

2216. Strong Cement for Iron. To 4 or 5 parts clay, thoroughly dried and pulverized, add 2 parts iron filings free from oxide, 1 part peroxide of manganese, ½ part of sea salt, and ½ part borax. Mingle thoroughly, and render as fine as possible; then reduce to a thick paste with the necessary quantity of water, mixing thoroughly. It must be used immediately. After application, it should be exposed to warmth, gradually increasing almost to white heat. This cement is very hard, and presents complete resistance alike to a red heat and boiling water.

2217. Cement for Iron. An excellent cement is made by mixing equal parts of sifted peroxide of manganese and well-pulverized zinc white, adding a sufficient quantity of commercial soluble glass to form a thin paste. This mixture, when used immediately, forms a cement quite equal in hardness and resistance to that given in the last receipt.

2218. Cement for Uniting Stone, Derbyshire Spar, etc. Melt together 4 ounces resin, ½ ounce wax, and about an ounce finely-sifted plaster of Paris. The articles to be joined should be well cleaned, then made hot enough to melt the cement, and the pieces pressed together very closely, so as to leave as little as possible of the composition between the joints. This is a general rule with all cements, as the thinner the stratum of cement interposed the firmer it will hold.

2219. Cheap Artificial Building Stone. A large number of houses have been constructed in Paris, for workmen, of the following materials: 100 parts plaster of Paris, 10 parts hydraulic lime, 5 parts liquid glue, and 500 parts cold water, are intimately mixed and poured into moulds of any desired size and shape; and in half an hour the form can be removed. The stones are then exposed in the open air for 2 weeks, until they are thoroughly dry. Artificial stone thus prepared, has the ring and hardness of the native rock; and, where the materials are abundant, is said to be 25 per cent. cheaper than quarried stone.

2220. Simple and Useful Cement. Alum and plaster of Paris, well mixed in water and used in the liquid state, form a hard composition and also a useful cement.

2221. Cement for Fastening Instruments in Handles. A material for fastening knives or forks into their handles, when they have become loosened by use, is a much-needed article. The best cement for this purpose consists of 1 pound resin and 8 ounces sulphur, which are to be melted together and either kept in bars or reduced to powder. 1 part of the powder is to be mixed with ½ a part of iron filings, fine sand, or brick-dust, and the cavity of the handle is then to be filled with this mixture. The stem of the knife or fork is then to be heated and inserted into the cavity; and when cold it will be found firmly fixed in its place.

2222. Cement for Fastening Iron to Stone. Glycerine and litharge stirred to a paste, hardens rapidly, and makes a suitable cement for iron upon iron, for two stone surfaces, and especially for fastening iron to stone. The cement is insoluble, and is not attacked by strong acids.

2223. Vegetable Cement. A good vegetable cement may be prepared by mixing gum-arabic with *nitrate of lime.* The latter is prepared by dissolving an excess of marble in nitric acid, and filtering. The filtered solution will contain 33.3 per cent. nitrate of lime, which may be dried by evaporation. For the cement, take 2 parts by weight of the nitrate of lime, 20 parts pulverized gum-arabic, and 25 parts water. The mixture can be further diluted to adapt it to the uses to which it is to be applied. In the manufacture of artificial stone, a cement of a similar character has been found to serve a good purpose. Something of the kind is used in the Frear stone, but in the Béton-Coignet no additional binding material is found necessary.

2224. Cement for Leaky House Roofs. Take 4 pounds resin, 1 pint linseed oil, 2 ounces red lead, and stir in pulverized sand until the proper consistency is secured, and apply it warm. This cement becomes hard and yet possesses considerable elasticity, and is durable and waterproof.

2225. Engineer's Cement. Mix ground white lead with as much powdered red lead as will make it of the consistence of putty. This cement is employed by engineers and others to make metallic joints. A washer of hemp, yarn, or canvas, smeared with the cement, is placed in the joint, which is then screwed up tight. It dries as hard as stone. This cement answers well for joining broken stones, however large. Cisterns built of square stones, put together, while dry, with this cement, will never leak or require repair. It is only necessary to use it for an inch or two next the water; the rest of the joint may be filled with good mortar. It is better, however, to use it for the whole joint. (*See No.* 2169.)

2226. Plumbers' Cement. Melt 1 pound black resin, then stir in 1 to 2 pounds brick-dust. Sometimes a little tallow is added.

2227. Red Cement. The red cement used for uniting glass to metals is made by melting 5 parts black resin with 1 part yellow wax, and then stirring in gradually 1 part red ochre or Venetian red, in fine powder, and previously well dried, This cement requires to be melted before use, and it adheres better if the objects to which it is applied are warmed.

2228. Turners' Cement. Melt together bees' wax, 1 ounce; resin, ½ ounce; and pitch, ½ ounce; stir in the mixture some very fine brick-dust to give it a body. If too soft, add more resin; if too hard, more wax. When nearly cold, make it up into cakes or rolls for use. Used for fastening wood on a turner's chuck.

2229. Temporary Cement for Opticians, Jewelers, &c. A temporary cement to fix optical glasses, stones, jewelry, &c., on stocks or handles for the purpose of painting, repairing, or ornamenting, is made by melting together at a good heat, 2 ounces resin, 1 drachm wax, and 2 ounces whitening; with this applied to the article when heated, a secure hold may be obtained, unfixed at pleasure by heat.

2230. Cement for Fixing Metal to Leather. Wash the metal in hot gelatine, steep the leather in hot gall-nut infusion, and unite while hot.

2231. Cement for Fixing Metal to Marble, Stone, or Wood. Mix together 4 parts carpenters' glue and 1 part Venice turpentine.

2232. Cement for Coating Acid Troughs. Melt together 1 part pitch, 1 part resin, and 1 part plaster of Paris (perfectly dry.)

2233. To Cement Cloth to Polished Metal. Cloth can be cemented to polished iron shafts, by first giving them a coat of best white lead paint; this being dried hard, coat with best Russian glue, dissolved in water containing a little vinegar or acetic acid.

2234. Cement for Gas Retorts. A new cement, especially adapted to the retorts of gas-works, is very warmly recommended in a German gas-light journal. It consists of finely-powdered barytes and a soluble water-glass; or the barytes and a solution of borax. The joints are to be coated several times with this cement, by means of a brush. The addition of two-thirds of a part of clay improves the cement, and the retorts will then stand a red heat very well. Instead of the water-glass, a solution of borax may be used, or even finely powdered white glass.

2235. Use of Silicate of Potassa in Strengthening Fossil Skeletons. A very judicious application of the silicate of potassa (liquid glass) has been lately made at the Museum of Natural History of Paris, in repairing a great many fossil skeletons which had been disjointed and broken by the shells bursting in this Palace of Science. The solutions have been first used diluted to about 30° Baumé, and afterwards of a higher degree of concentration. The adherence of the broken or separated pieces is brought together by applying with a brush some of the solution of the silicate of potassa on the parts to be joined, then they are left to dry, and the joint is hardly visible; and the joined part is far stronger than the remainder of the bone. Very delicate and porous anatomical pieces, as skeletons of birds, insects, etc., can be dipped repeatedly in more diluted solutions, and thus be rendered very hard and tenacious.

2236. Transparent Cement for Lenses, &c. It is frequently found necessary to cement together two surfaces of transparent glass, without destroying or injuring their transparency; this is especially the case in compound lenses. The best cement for effecting the union is Canada balsam, which, if too thick, should be thinned with a little turpentine, benzole, or ether. It is of importance that no air bubbles be present. In order to cement together the two parts of an achromatic lens (this consists of a double convex lens fitting exactly into the concavity of a plano-concave lens), having thoroughly cleaned the surfaces to be brought in contact, lay the glass, previously made warm, on a table suitably covered to prevent the under surface from being scratched. By means of a peg of wood or otherwise, convey a drop of the balsam to the centre of the lens, and then gently lower down upon it the lens to be cemented to it, also previously made slightly warm. Now apply a slight pressure, and the dark disc in the centre, indicative of optical contact, will rapidly increase in size, until at last the balsam reaches the margin and begins to ooze out at the edges, if the balsam be present in excess, as it should be. By means of a piece of soft string passed crosswise over the lenses, tie the two together, and place them in a stove, an oven, or before a fire, for a short time, until the balsam at the edges shall have become hard and dry. Let the string then be removed and the lens freed from all external traces of balsam by means of benzole or ether. The above directions, modified to suit circumstances, apply to the cementation of transparencies or opal pictures; also to the varnishing of magic lantern slides, and the protection of any transparent surfaces from the air.

2237. Cement for Chemical Glasses. Mix equal parts of wheat flour, finely-powdered Venice glass, pulverized chalk, and a small quantity of brick-dust, finely ground; these ingredients, with a little scraped lint, are to be mixed and ground up with the white of eggs; it must then be spread upon pieces of fine linen cloth, and applied to the crack of the glasses, and allowed to get thoroughly dry before the glasses are put to the fire.

2238. Hermetical Sealing for Bottles. Gelatine mixed with glycerine yields a compound, liquid when hot, but becoming solid by cooling, at the same time retaining much elasticity. Bottles may be hermetically sealed by dipping their necks into the liquid mixture, and repeating the operation until the cap attains any thickness required.

2239. Cement to Seal Bottles Containing Volatile Liquids. Chemists and others know well the difficulty of keeping volatile liquids. Bottles of ether, for example, are shipped for India, and when they arrive are found to be more than half empty. The remedy with exporters is a luting of melted sulphur, which is difficult to apply and hard to remove. A new cement, easily prepared and applied, and which is said to prevent the escape of the most volatile liquids, is composed of very finely ground litharge and concentrated glycerine, and is merely painted around the cork or stopper. It quickly dries and becomes extremely hard, but can be easily scraped off with a knife when it is necessary to open the bottle.

2240. Cement for Sealing Corks in Bottles. Take an equal quantity of resin and bees' wax, melt them together, then put in an almost equal bulk of finely-powdered red chalk, add a small quantity of neatsfoot oil, let the whole boil 1 minute, then take it from the fire and stir it well; if too thick, add a little more oil.

2241. Cement for Sealing the Corks in Bottles. Melt together ¼ pound sealing-wax, the same quantity of resin, and 2 ounces bees' wax. When it froths stir it with a tallow candle. As soon as it melts dip the mouths of the corked bottles in it.

2242. Painters' Putty. Putty is made of common whitening, pounded very fine, and mixed with linseed oil till it becomes about the thickness of dough.

2243. Quick Hardening Putty. A putty of starch and chloride of zinc hardens quickly, and lasts for months, as a stopper of holes in metals.

2244. **Cement to Stop Flaws or Cracks in Wood of any Color.** Put any quantity of fine sawdust, of the same wood the work is made with, into an earthen pan, and pour boiling water on it, stir it well, and let it remain for a week or ten days, occasionally stirring it; then boil it for some time, and it will be of the consistence of pulp or paste; put it into a coarse cloth, and squeeze all the moisture from it. Keep for use, and, when wanted, mix a sufficient quantity of thin glue to make it into a paste; rub it well into the cracks, or fill up the holes in the work with it. When quite hard and dry, clean the work off, and, if carefully done, the imperfection will be scarcely discernible.

2245. **Cement for Cloth, Leather, or Belting.** Take ale, 1 pint; best Russia isinglass, 2 ounces; put them into a common glue kettle and boil until the isinglass is dissolved; then add 4 ounces best glue, and dissolve it with the other; then slowly add 1½ ounces boiled linseed oil, stirring all the time while adding and until well mixed. When cold it will resemble India rubber. To use this, dissolve what is needed in a suitable quantity of ale to the consistence of thick glue. It is applicable for leather, for harness, bands for machinery, cloth belts for cracker machines for bakers, &c., &c. If for leather, shave off as if for sewing, apply the cement with a brush while hot, laying a weight to keep each joint firmly for 6 to 10 hours, or over night.

2246. **Cement for Leather Belting.** Take of common glue and American isinglass, equal parts; place them in a glue-pot and add water sufficient to just cover the whole. Let it soak 10 hours, then bring the whole to a boiling heat, and add pure tannin until the whole becomes ropey or appears like the white of eggs. Apply it warm. Buff the grain off the leather where it is to be cemented; rub the joint surfaces solidly together, let it dry a few hours, and it is ready for use; and, if properly put together, it will not need riveting, as the cement is nearly of the same nature as the leather itself. We know of no cement better either for emery wheels or emery belts than the best glue. In an experience of fifteen years we never found anything superior.

2247. **Gutta-Percha Cement.** This highly recommended cement is made by melting together, in an iron pan, 2 parts common pitch and 1 part gutta-percha, stirring them well together until thoroughly incorporated, and then pouring the liquid into cold water. When cold it is black, solid, and elastic; but it softens with heat, and at 100° Fahr. is a thin fluid. It may be used as a soft paste, or in the liquid state, and answers an excellent purpose in cementing metal, glass, porcelain, ivory, &c. It may be used instead of putty for glazing windows.

2248. **To Dissolve India Rubber for Cement, &c.** India rubber dissolves readily in rectified sulphuric ether, which has been washed with water to remove alcohol and acidity; also in chloroform. These make odorless solutions, but are too expensive for general use. The gum dissolves easily in bisulphuret of carbon; or a mixture of 94 parts bisulphuret of carbon and 6 parts absolute alcohol; also in caoutchoucine. (*See No.* 2249.) These dissolve the gum rapidly in the cold, and leave it unaltered on evaporation; they have a disagreeable odor, but they leave the India rubber in better condition than most other solvents. Oil of turpentine, rendered pyrogenous by absorbing it with bricks of porous ware, and distilling it without water, and treating the product in the same way, is also used for this purpose. It is stated that the solution on evaporation does not leave the caoutchouc in a sticky state. Another method is to agitate oil of turpentine repeatedly with a mixture of equal weights of sulphuric acid and water; and afterwards expose it to the sun for some time. Benzole, rectified mineral or coal tar naphtha, and oil of turpentine reduce the gum slowly by long digestion and trituration, with heat, forming a glutinous jelly which dries slowly, and leaves the gum, when dry, very much reduced in hardness and elasticity. The fats and fixed oils combine readily with India rubber by boiling, forming a permanently glutinous paste. (*See No.* 2947.) India rubber is rendered more readily soluble by first digesting it with a solution of carbonate of soda, or water of ammonia.

2249. **Caoutchoucine.** Pure India rubber, cut into small lumps, is thrown into a cast-iron still, connected with a well-cooled worm tub, and heat is applied until the thermometer ranges about 600° Fahr., when nothing is left in the still but dirt and charcoal. The dark colored fetid oil which has distilled over is next rectified with one third its weight of water, once or oftener, until it is colorless; it is then highly volatile and of .680 specific gravity. The product is then shaken up with nitro-muriatic acid, or chlorine, in the proportion of ¼ pint of acid to each gallon of the liquid. This is the lightest fluid known, and yet its vapor is the heaviest of gases. Mixed with alcohol, it dissolves all the resins, especially copal and India rubber, at the common temperature of the air; and it speedily evaporates, leaving them in a solid state. It mixes with the oils in all proportions; and has been used for making varnishes, and for liquefying oil paints, instead of turpentine. It is very volatile, and must be kept in close vessels.

2250. **Cement for Uniting Sheet Gutta-Percha to Silk, &c.** Gutta-percha, 40 pounds; caoutchouc, 3 pounds; shellac, 3 pounds; Canada balsam, or Venice turpentine, 14 pounds; liquid storax, 35 pounds; gum mastic, 4 pounds; oxide of lead, 1 pound. Mix as directed in the next receipt.

2251. **Cement for Uniting Sheet Gutta-Percha to Leather.** For uniting sheet gutta-percha to leather, as soles of shoes, etc. Gutta-percha, 50 pounds; Venice turpentine, 40 pounds; shellac, 4 pounds; caoutchouc, 1 pound; liquid storax, 5 pounds. In making the cement, the Venice turpentine should be first heated; then the gutta-percha and the shellac should be added; the order in which the other materials are added is not important. Care should be taken to incorporate them thoroughly, and the heat should be regulated, so as not to burn the mixture.

2252. **Transparent Cement.** Dissolve 75 parts India rubber in 60 parts of chloroform, and add to the solution 15 parts of gum mastich.

2253. How to Fasten Rubber to Wood and Metal. As rubber plates and rings are now-a-days almost exclusively used for making connections between steam and other pipes and apparatus, much annoyance is often experienced by the impossibility or imperfectness of an air-tight connection. This is obviated entirely by employing a cement which fastens equally well to the rubber and to the metal or wood. Such cement is prepared by a solution of shellac in ammonia. This is best made by soaking pulverized gum-shellac in ten times its weight of strong ammonia, when a slimy mass is obtained, which, in three to four weeks, will become liquid without the use of hot water. This softens the rubber, and becomes, after volatilization of the ammonia, hard and impermeable to gases and fluids.

2254. Marine Cement for Uniting Leather to Gutta-Percha. This will unite leather to gutta-percha, and is impervious to damp. It is made by dissolving by the aid of heat, 1 part India rubber in naphtha, and, when melted, adding 2 parts shellac, and melting until mixed. Pour it while hot on metal plates to cool. When required for use, melt, and apply with a brush. This cement does not adhere very well to *vulcanized* rubber, and the joint is always weak.

2255. Cement to Unite India Rubber. Take 16 parts gutta-percha, 4 parts India rubber, 2 parts common caulkers' pitch, 1 part linseed oil. The ingredients are melted together, and used hot. It will unite leather or rubber that has not been vulcanized.

2256. Gutta-Percha Cement for Fastening Leather. Dissolve a quantity of gutta-percha in chloroform in quantity to make a fluid of honey-like consistence. When spread it will dry in a few moments. Heat the surfaces at a fire or gas flame until softened, and apply them together. Small patches of leather can be thus cemented on boots, etc., so as almost to defy detection, and some shoemakers employ it with great success for this purpose. It is waterproof, and will answer almost anywhere unless exposed to heat, which softens it.

2257. Caoutchouc Cement is made as follows:—Gutta-percha, 3 parts; virgin India rubber (caoutchouc), 1 part (both cut small); pyrogenous oil of turpentine, or bisulphuret of carbon, 8 parts; mix in a close vessel, and dissolve by the heat of hot water. This cement should be gently heated before being used.

2258. Cement to Mend India Rubber Shoes. A solution of caoutchouc, or virgin India rubber, for repairing India rubber shoes, is prepared in the following manner: Cut 2 pounds caoutchouc into thin, small slices; put them in a vessel of tinned sheet-iron and pour over 12 to 14 pounds of sulphide of carbon. For the promotion of solution, place the vessel in another containing water previously heated up to about 86° Fahr. The solution will take place promptly, but the fluid will thicken very soon, and thus render the application difficult, if not impossible. In order to prevent this thickening, a solution of caoutchouc and resin in spirits of turpentine must be added to the solution of caoutchouc in sulphide of carbon, and in such quantity that the mixture obtains the consistency of a thin paste. The solution of caoutchouc and resin in spirit of turpentine should be prepared as follows: Cut 1 pound of caoutchouc into thin, small slices; heat in a suitable vessel over a moderate coal fire, until the caoutchouc becomes fluid; then add ½ pound powdered resin, and melt both materials at a moderate heat. When these materials are perfectly fluid, then gradually add 3 or 4 pounds spirit of turpentine in small portions, and stir well. By the addition of the last solution, the rapid thickening and hardening of the compound will be prevented, and a mixture obtained fully answering the purpose of glueing together rubber surfaces, etc.

2259. To Fasten Chamois and Other Leather to Iron and Steel. Dr. Carl W. Heinischen, of Dresden, gives the following receipt for the above purpose: Spread over the metal a thin, hot solution of good glue; soak the leather with a warm solution of gall-nuts before placing on the metal, and leave to dry under an even pressure. If fastened in this manner it is impossible to separate the leather from the metal without tearing it.

2260. Cement for Petroleum Lamps. A cement particularly adapted for attaching the brass work to petroleum lamps, is made by Puscher, by boiling 3 parts resin with 1 of caustic soda and 5 of water. The composition is then mixed with half its weight of plaster of Paris, and sets firmly in half to three-quarters of an hour. It is said to be of great adhesive power, not permeable to petroleum, a low conductor of heat, and but superficially attacked by hot water. Zinc white, white lead, or precipitated chalk may be substituted for plaster, but hardens more slowly.

2261. Cement for Attaching Metal Letters to Plate Glass. Copal varnish, 16 parts; drying oil, 6 parts; turpentine, and *oil* of turpentine, of each 3 parts; liquefied glue (made with the least possible quantity of water), 5 parts. Melt together in a water-bath, and add fresh slacked lime (perfectly dry and in very fine powder), 10 parts.

2262. Cement for Metal and Glass. Mix 2 ounces of a thick solution of glue with 1 ounce linseed oil varnish, or ¾ ounce Venice turpentine; boil them together, stirring them until they mix as thoroughly as possible. The pieces cemented should be tied together for 2 or 3 days. This cement will firmly attach any metallic substance to glass or porcelain. (*See last receipt.*)

Lute. A composition employed to secure the joints of chemical vessels, or as a covering to protect them from the violence of the fire. For the joints of vessels, as stills, &c., not exposed to a heat much higher than 212° Fahr., linseed meal, either alone or mixed with an equal weight of whiting, and made into a stiff paste with water, may be employed. Ground almond cake, from which the oil has been pressed, may also be used for the same purpose. For the joints of small vessels, as tubes, &c., especially of glass or earthenware, small rings of India rubber slipped over and tied above and below the joint, are very convenient substitutes for lutes, and have the advantage of lasting a long time, and bearing uninjured the heat at which oil of vitriol boils.

2264. Lute for Stills. A very useful lute is formed by beating the white of an egg thoroughly with an equal quantity of water, and mixing it with some slacked lime in the state of fine powder, so as to form a thin paste. This must be spread immediately on strips of muslin, and applied to the cracks or joints intended to be luted. It soon hardens, adheres strongly, and will bear a heat approaching to redness without injury. A leak in this lute is readily stopped by the application of a fresh portion. Solution of glue, or any liquid albuminous matter, may be used in place of the white of eggs.

2265. Lemery's Lute for Stills or Retorts. Lemery used the following lute for stopping retorts, etc.: Fine flour and fine lime, of each 1 ounce; potter's earth, ½ ounce; make a moist paste of these with white of egg, well beaten up with a little water; this will be found to stop exceedingly close.

2266. Boyle's Lute for Retorts, &c. Boyle recommends, on experience, the following for the same purpose: Some good fine quicklime and scrapings of cheese, pounded in a mortar, with as much water as will bring the mixture to soft paste; then spread on a piece of linen rag, and apply it as occasion requires.

2267. Useful Lute. A useful lute is made by spreading a solution of glue on strips of cloth, and coating them, after they are applied, with drying oil.

2268. Lute for Joining Crucibles. For joining crucibles to be exposed to a strong heat, a mixture of fine clay and ground bricks, mixed up with water, or preferably with a solution of borax, answers well for most purposes.

2269. Fire Lute. As a coating for vessels, to preserve them from injury from exposure to the fire, nothing is better than a mixture of ordinary pipe-clay and horse dung, made into a paste with water. This composition is used by the pipe-makers, and will stand unharmed the extreme heat of their kiln for 24 hours. It is applied by spreading it on paper.

2270. Lute to Protect Glass Vessels. The following composition will enable glass vessels to sustain an incredible degree of heat: Take fragments of porcelain, pulverize, and sift them well, and add an equal quantity of fine clay, previously softened with as much of a saturated solution of muriate of soda as is requisite to give the whole a proper consistence. Apply a thin and uniform coat of this composition to the glass vessels, and allow it to dry slowly before they are put into the fire.

Flour Paste. The best paste for general purposes is simply wheat flour beaten into cold water to perfect smoothness, and the whole just brought to a boil, while being constantly stirred to prevent burning. The addition of a few drops of creosote, or a few grains of corrosive sublimate, or a little carbolic acid, or bisulphite of lime (especially the first and second), will prevent insects from attacking it, and preserve it (in covered vessels) for years. Should it get too hard it may be softened with water.

2272. Paper Hangers' Paste. Beat up 4 pounds of good white wheat flour in cold water—enough to form a stiff batter (sifting the flour first); beat it well, to take out all lumps; then add enough cold water to make it the consistence of pudding batter; add about 2 ounces of well pounded alum. Be sure and have plenty of boiling water ready; take it quite boiling from the fire, and pour gently and quickly over the batter, stirring rapidly at the same time; and when it is observed to swell and lose the white color of the flour, it is cooked and ready. This will make about ¾ of a pail of solid paste; do not use it while hot; allow it to cool and it will go further; about a pint of cold water may be put over the top of it, to prevent it skinning; before using, thin this with cold water to spread easily and quickly under the brush. This paste will keep a long while without fermenting, when it is useless; mould on the top does not hurt it; remove it, the remainder is good. (*See No.* 2273.)

2273. Strongly Adhering Paste. Where great adhesiveness is required, such as papering over varnished paper or painted walls, it will be necessary to add ½ an ounce of finely powdered resin to each ½ gallon of the batter in the last receipt. As the resin does not dissolve so readily, set the pan containing the ingredients over a moderate fire, constantly stirring until it boils and thickens, and a short time after put out to cool. Reduce the paste with thin gum-arabic water. In hanging "flock" papers with crimson in them, omit the alum, as it will injure the color.

2274. To Make a Fine Paste. A solution of 2½ ounces gum-arabic in 2 quarts warm water, is thickened to a paste with wheat flour; to this is added a solution of alum and sugar of lead, 1½ ounces each in water; the mixture is heated and stirred about to boil, and is then cooled. It may be thinned, if necessary, with a gum solution.

2275. To Make Paste for Laying Cloth or Leather on Table Tops. To 1 pint best wheaten flour add resin, very finely powdered, about 2 large spoonfuls; of alum, 1 spoonful, in powder; mix them all well together, put them into a pan, and add by degrees soft or rain water, carefully stirring it till it is of the consistence of thinnish cream; put it into a saucepan over a clear fire, keeping it constantly stirred, that it may not get lumpy. When it is of a stiff consistence, so that the spoon will stand upright in it, it is done enough. Be careful to stir it well from the bottom, for it will burn if not well attended to. Empty it out into a pan and cover it over till cold, to prevent a skin forming on the top, which would make it lumpy. This paste is very superior for the purpose, and adhesive.

2276. To Paste Leather or Cloth on Table Tops. To use paste in the last receipt, for cloth or baize, spread the paste evenly and smoothly on the top of the table, and lay your cloth on it, pressing and smoothing it with a flat piece of wood; let it remain till dry; then trim the edges close to the cross-banding. If you cut it close at first, it will, in drying, shrink and look bad where it meets the banding all around. If used for leather, the leather must be first previously dampened, and then the paste spread over it; next lay it on the table, and rub it smooth and level with a linen cloth, and cut the edges close to the banding with a short knife. Some lay their table-covers with glue instead of paste, and for cloth perhaps it is the best method; but for leather it is not proper, as glue is apt to run through. In using it for cloth, great care must be taken that the glue is not too thin, and that the cloth be well rubbed down with a thick piece of wood made hot at the fire, for the glue soon chills. You may, by this method, cut off the edges close to the border at once.

Glue. The hotter the glue, the more force it will exert in keeping the two parts glued together; therefore, in all large and long joints the glue should be applied immediately after boiling. Glue loses much of its strength by frequent re-melting; that glue, therefore, which is newly made, is much preferable to that which has been re-boiled. In melting ordinary glue in the double vessel containing water, it is an excellent method to add salt to the water in the outer vessel. It will not boil then, until heated considerably above the ordinary boiling point; the consequence is, the heat is retained, instead of passing off by evaporation, and when the water boils, the glue will be found to be thorougly and evenly melted.

2278. To Prevent Glue from Cracking. Glue is often found to crack in very dry localities, particularly when the objects glued together are not in close contact, but have a thin layer of glue between them; in which case they sometimes fall apart. Very thin layers of glue are not only exceedingly hard, but also more or less brittle when extremely dry; and, therefore, to prevent this dry and consequent brittle condition, the addition of a very small quantity of glycerine will accomplish the desired end. The quantity of glycerine must be modified according to circumstances.

2279. To Make a Very Strong Glue. An ounce of the best isinglass may be dissolved, by the application of a moderate heat, in a pint of water. Take this solution and strain it through a piece of cloth, and add to it a proportionate quantity of the best glue, which has been previously soaked in water for about 24 hours, and a gill of vinegar. After the whole of the materials have been brought into a solution, let it once boil up, and strain off the impurities. This glue is well adapted for any work which requires particular strength, and where the joints themselves do not contribute towards the combination of the work; or in small fillets and mouldings, and carved patterns that are to be held on the surface by the glue.

2280. A Strong Glue that will Resist Moisture. Dissolve gum-sandarac and mastich, of each ¼ ounce, in ¼ pint spirits of wine, to which add ¼ ounce clear turpentine; now take strong glue, or that in which isinglass has been dissolved; then, putting the gums into a double glue-pot, add by degrees the glue, constantly stirring it over the fire till the whole is well incorporated; strain it through a cloth, and it is ready for use. It may now be returned to the glue-pot, and ½ ounce very finely-powdered glass added; use it quite hot.

2281. To Make Tungstic Glue. Tungstic glue is prepared by mixing a thick solution of glue with tungstate of soda, and hydrochloric acid, by means of which a compound of tungstic acid and glue is precipitated, which, at a temperature of 86° to 104° Fahr., is sufficiently elastic to admit of being drawn out into very thin sheets. On cooling, this mass becomes solid and brittle, and on being heated is again soft and plastic. This new compound, it is said, can be used for all the purposes to which hard rubber is adapted.

2282. To Keep Glue from Souring. If a little muriatic acid be put into glue when it is dissolved, ready for use, it will retain the glue in the same condition for a long time. It will neither dry up nor ferment. Liquid glue is made in this way, and sold in bottles. The use of a small portion of sugar of lead will also prevent fermentation.

2283. To Prepare Glue for Ready Use. To any quantity of glue use common whiskey instead of water. Put both together in a bottle, cork it tight, and set it for 3 or 4 days, when it will be fit for use without the application of heat. Glue thus prepared will keep for years, and is at all times fit for use, except in very cold weather, when it should be set in warm water before using. To obviate the difficulty of the stopper getting tight by the glue drying in the mouth of the vessel, use a tin vessel with the cover fitting tight on the outside, to prevent the escape of the spirit by evaporation. A strong solution of isinglass made in the same manner is an excellent cement for leather.

2284. Liquid Glue. The preparation of liquid glue is based upon the property of the concentrated acid of vinegar and diluted nitric acid to dissolve the gelatine without destroying its cohesive qualities. Dumoulin has given the following receipt:

2285. Dumoulin's Liquid and Unalterable Glue. Take a wide-mouthed bottle, and dissolve in it 8 ounces best glue in ½ pint water, by setting it in a vessel of water, and heating until dissolved. Then add slowly 2½ ounces strong aqua fortis (nitric acid) 36° Baumé, stirring all the while. Effervescence takes place under generation of nitrous gas. When all the acid has been added, the liquid is allowed to cool. Keep it well corked, and it will be ready for use at any moment. This preparation does not gelatinize, nor undergo putrefaction or fermentation. It is applicable for many domestic uses, such as mending china, repairing cabinet work, &c.

2286. Russian Liquid Glue. This is prepared by softening 100 parts best Russian glue in 100 parts warm water, and then adding slowly from 5½ to 6 parts aqua fortis, and finally 6 parts powdered sulphate of lead. The latter is used in order to impart to it a white color.

2287. Pale Liquid Glue. Dissolve in a glass vessel 100 parts pale "steam glue" in double its weight of water, and add 12 parts aqua fortis as directed in Dumoulin's receipt. (*See No.* 2285.)

2288. Dark Liquid Glue. Put 100 parts dark "steam glue" and 140 parts water in a wide-mouthed glass bottle, and dissolve the glue in the water, then add slowly 16 parts aqua fortis, stirring all the while. When all the acid is added, the liquid is allowed to cool. Cork well. This liquid glue exhibits a greater cohesive force than that prepared after Dumoulin's receipt. (*See No.* 2285.) However, still better kinds of liquid glue or mucilage are obtained by dissolving gelatine or dextrine in acetic acid and alcohol.

2289. Good Liquid Glue. Fill a glass jar with broken-up glue of best quality, then fill it with acetic acid. Keep it in hot water for a few hours, until the glue is all melted, and you will have an excellent glue always ready.

2290. Glue which Stands Moisture Without Softening. Dissolve, in about 8 fluid ounces of strong methylated spirit, ½ an ounce each of sandarac and mastich; next, add ½ an ounce of turpentine. This solution is then added to a hot, thick solution of glue to which isinglass has been added, and is next filtered, while hot, through cloth or a good sieve. (*See No.* 2280.)

2291. Marine or Waterproof Glue. Take of gum shellac 3 parts, caoutchouc (India-rubber), 1 part, by weight. Dissolve the caoutchouc and shellac in separate vessels, in ether free from alcohol (*see No.* 2248), applying a gentle heat. When thoroughly dissolved, mix the two solutions, and keep in a bottle tightly stoppered. This glue resists the action of water, both hot and cold, and most of the acids and alkalies. Pieces of wood, leather or other substances, joined together by it, will part at any other point than at the joint thus made. If the glue be thinned by the admixture of ether, and applied as a varnish to leather, along the seams where it is sewed together, it renders the joint or seam water-tight, and almost impossible to separate.

2292. Isinglass Glue. Dissolve isinglass in water and strain through coarse linen, and then add a little spirits of wine. Evaporate it to such a consistency that when cold it will be dry and hard. This will hold stronger than common glue, and is much preferred.

2293. India-Rubber Glue for Photographers and Bookbinders. A most valuable glue for photographers, and extensively used by first-class bookbinders, is made from bottle India rubber. This must be dissolved in highly rectified spirits of turpentine; the highly rectified spirit extracts every particle of grease, which is of the greatest consequence.

2294. Braconnot's Glue of Caseine. Dissolve caseine in a strong solution of bicarbonate of soda.

2295. Wagner's Glue of Caseine. Dissolve caseine in a cold saturated solution of borax. Superior to gum, and may take the place of glue in many cases. May be used for the backs of adhesive tickets.

2296. To Glue a Joint. In general, nothing more is necessary to glue a joint, after the joint is made perfectly straight, than to glue both edges while the glue is quite hot, and rub them lengthwise until it has nearly set. When the wood is spongy, or sucks up the glue, another method must be adopted—one which strengthens the joint, while it does away with the necessity of using the glue too thick, which should always be avoided; for the less glue there is in contact with the joints, provided they touch, the better; and when the glue is thick, it chills quickly, and cannot be well rubbed out from between the joints. The method to which we refer is, to rub the joints on the edge with a piece of soft chalk, and, wiping it so as to take off any lumps, glue it in the usual manner; and it will be found, when the wood is porous, to hold much faster than if used without chalking.

2297. To Glue on Ivory Veneers. To glue on ivory veneers, take 2 parts pulverized gum-arabic and 1 part calomel, and add water sufficient to make a paste.

2298. Excellent Liquid Glue. Take of best white glue, 16 ounces; white lead, dry, 4 ounces; rain water, 2 pints; alcohol, 4 ounces. With constant stirring dissolve the glue and lead in the water by means of a water-bath. Add the alcohol and continue the heat for a few minutes. Lastly pour into bottles while it is still hot. This is said to be superior to "Spaulding's liquid glue."

2299. Glycerine Paste for Office Use. Glycerine paste for office use may be prepared by dissolving 1 ounce gum-arabic and 2 drachms of glycerine in 3 ounces boiling water.

2300. Government Postage Stamp Mucilage. The substance used for gumming stamps is made as follows. Gum dextrine, 2 parts; acetic acid, 1 part; water, 5 parts. Dissolve in a water-bath, and add alcohol, 1 part.

2301. Mucilage for Labels. Macerate 5 parts good glue in 18 to 20 parts water for a day, and to the liquid add 9 parts rock candy and 3 parts gum-arabic. The mixture can be brushed upon paper while lukewarm; it keeps well, does not stick together, and, when moistened, adheres firmly to bottles.

2302. Mucilage for Soda or Seltzer Water Bottles. For the labels of soda or seltzer water bottles it is well to prepare a paste of good rye flour and glue to which linseed oil varnish and turpentine have been added in the proportion of ½ an ounce of each to the pound. Labels prepared in the latter way do not fall off in damp cellars.

2303. Very Strong Liquid Glue. To make this, put 3 parts glue in 8 parts cold water, and let them stand for several hours to soften the glue; then add ½ part muriatic acid and ¾ part sulphate of zinc, and heat the mixture to 185° Fahr., for 10 or 12 hours. The mixture remains liquid after cooling, and is said to be very useful for sticking wood, crockery, and glass together.

2304. Good Mucilage. For household purposes this may be made by mixing 3 ounces gum-arabic, 3 ounces distilled vinegar, with 1 ounce white sugar. Instead of the distilled vinegar, 1 part acetic acid and 5 parts water may be substituted.

2305. To Prevent Mould in Mucilage. Solutions of gum-arabic are very liable to become mouldy; and while the introduction of creosote, corrosive sublimate, etc., frequently used to remedy this evil, is objectionable on account of the danger of poisoning, according to the "Industrie Blätter," sulphate of quinine is a complete protection against mould, a very small quantity of it being sufficient to prevent gum mucilage from spoiling. It is quite possible that writing ink might be protected, by the same application, from a like difficulty. The use of ammonia for the same purpose is also recommended.

2306. Elastic Glue which does not spoil is obtained as follows: Good common glue is dissolved in water, on the water-bath, and the water evaporated down to a mass of thick consistence, to which a quantity of glycerine, equal in weight with the glue, is added, after which the heating is continued until all the water has been driven off, when the mass is poured out into moulds, or on a marble slab. This mixture answers for stamps, printers' rolls, galvano-plastic copies, etc.

2307. Sweet Mouth Glue. Sweet glue, for ready use by moistening with the tongue, is made in the same way as elastic glue, substituting, however, the same quantity of powdered sugar for the glycerine.

2308. Portable Glue or Bank-Note Cement. Boil 1 pound best glue, strain it very clear; boil also 4 ounces isinglass; put it into a double glue-pot, with ½ pound fine brown sugar, and boil it pretty thick; then pour it into plates or moulds. When cold, you may cut and dry them for the pocket. This glue is very useful to draughtsmen, architects, &c., as it immediately dilutes in warm water, and fastens the paper without the process of damping; or, it may be used by softening it in the mouth, and applying it to the paper.

2309. To Make Mucilage that will Adhere to Glass or Polished Surfaces. We all know the difficulty of causing labels and similar objects to stick to glass or highly varnished articles exposed to the continued drying action of a very warm room. The gum or paste dries up and cracks, causing the label to fall off. One or two drops of glycerine in a small bottle of mucilage will entirely prevent this result. Too much glycerine must not be added, or the cement will fail to harden at all.

2310. Mucilage of Tragacanth. Triturate 1 drachm powdered gum tragacanth in a mortar with 6 drachms glycerine; add by degrees, with constant trituration, 10 fluid ounces water. This will produce a mucilage at once, without the objectionable air-bubbles incidental to agitation.

2311. Mucilage of Tragacanth. Macerate 1 ounce tragacanth in 1 pint boiling water for 24 hours. Then triturate until smooth and uniform, and press through linen. If pretty firm this paste keeps well without the addition of an antiseptic, although a little acetic acid or creosote will more effectually prevent fermentation.

Sealing-Wax.

All the following receipts for *fine* wax produce *superfine* by employing the best qualities of the ingredients; and *extra superfine* or *scented* by adding 1 per cent. of balsam of Peru or liquid storax to the ingredients when considerably cooled. The fancy kinds are commonly scented with a little essence of musk or ambergris, or any of the more fragrant essential oils. The addition of a little camphor, or spirit of wine, makes sealing-wax burn easier. Sealing-wax containing resin, or too much turpentine, runs into thin drops at the flame of the candle.

2313. Fine Red Sealing-Wax. Melt cautiously 4 ounces very pale shellac in a bright copper pan over a clear charcoal fire, at the lowest degree of heat that will be necessary to melt it; when melted, stir in 1¼ ounces Venice turpentine (previously warmed), followed by 3 ounces vermilion. The heat must be neither too much nor too little, but just sufficient to allow a most thorough mixing of the different ingredients. When this is accomplished, the fluid mass is discharged into metallic moulds and left to cool. For the purpose of melting the shellac more easily, some add to the same a little alcohol. Or: 3 pounds shellac, 1¼ pounds Venice turpentine, and 2 pounds finest cinnabar, mixed in the same manner as the preceding.

2314. To Produce a Polish on Sealing-Wax. After the above process the sticks of sealing-wax have no polish. To produce this they have to be heated again on the surface. For this purpose they are put in other moulds, made of polished steel, which are engraved with the desired ornaments. These moulds are heated only just sufficient to melt the sealing-wax on the surface, by which operation the sticks obtain a beautiful glossy appearance. The heating of the moulds to stamp the mark of the manufacturer can be readily performed with a spirit lamp.

2315. Common Red Sealing-Wax. Melt together 4 pounds resin and 2 pounds shellac; mix in, as in the last receipt, 1½ pounds each of Venice turpentine and red lead.

2316. Fine Black Sealing-Wax. Take 60 parts shellac, 30 parts finely-powdered ivory black, and 20 parts Venice turpentine; mixed as in No. 2313.

2317. Common Black Sealing-Wax. Mix together (*see No.* 2313) 6 pounds resin, 2 pounds each shellac and Venice turpentine, and sufficient lampblack to color.

2318. Gold Colored Sealing-Wax. This is made by stirring gold colored mica spangles into the melted resins just before they begin to cool. Or: By taking finely pulverized gold-leaf (*see No.* 25) or metal powder, and stirring them into the sealing-wax instead of the colors. A common kind is made as follows: 6 parts shellac, 2 white resin, 1 silver leaves.

2319. Marbled Sealing-Wax is made by mixing different kinds of sealing-wax together just as they begin to solidify.

2320. Yellow Sealing-Wax. Mix together 4 ounces pale shellac, 1¼ ounces resin, 2 ounces Venice turpentine, and ¾ ounce King's yellow (sulphuret of arsenic, or orpiment).

2321. Light Brown Sealing-Wax. Take 7½ ounces shellac and 4 ounces Venice turpentine; and color with 1 ounce brown ochre and ½ ounce cinnabar (red sulphuret of mercury or vermilion).

2322. Blue Sealing-Wax. Take 16 parts mastic, 4 turpentine, 8 mountain-blue, 3 burned selenite. The mountain-blue turns green by the heat of melting the mixture; therefore it is better to use fine indigo, or very fine Prussian blue; but in that case the shellac must be particularly light-colored.

2323. Dark Blue Sealing-Wax. Mix 7 ounces fine shellac, 3 ounces Venice turpentine, 1 ounce resin, and 1 ounce mineral blue.

2324. Green Sealing-Wax. Mix 4 ounces shellac, 2 ounces Venice turpentine, 1¼ ounces resin, ½ ounce King's yellow (*see No.* 2320), and ¼ ounce mineral blue. Or: 24 parts shellac, 12 mastic, 4 turpentine, 6 verdigris; colored with a mixture of yellow and indigo.

2325. To Make Perfumed Sealing-Wax. Any fine sealing-wax may be perfumed by mixing 1 per cent. of balsam of Peru, or liquid storax, to the ingredients when considerably cooled. A little essence of musk or ambergris will serve the same purpose. The addition of a little camphor or spirit of wine makes sealing-wax melt easier.

2326. To Improve the Appearance of Common Sealing-Wax. To make common sealing-wax appear to better advantage, the sticks, being still soft, are dipped in the powder of a better quality, and then superficially melted, so as to produce a thin coating.

2327. Soft Sealing-Wax for Diplomas. Take 16 parts yellow wax, 3 turpentine, 1 olive oil; after it is melted, the cinnabar, or other coloring matter, is stirred in the compound.

2328. To Take Proof-Impressions of Seals and Stamps. For this purpose the very best sealing-wax is melted as usual by a flame, and carefully worked on the surface to which it is applied, until perfectly even; the stamp is then firmly and evenly pressed into it. The flame of a spirit lamp is preferable, having no tendency to blacken the wax. A beautiful dead appearance is given to the impression by dusting the stamp, before using it, with a finely-powdered pigment of the same color as the wax; thus, for vermilion sealing-wax, powdered vermilion, &c.

Boiler Incrustations.

In a lengthy article on the subject, which appeared in the "Scientific American," Professor Chandler gives the substances referred to in the four following receipts, as having been recommended by practical men, for the purpose of preventing incrustations in boilers:

2330. Wood Chips, Bark, &c., as a Preventive of Incrustation. Catechu, nut-galls, oak bark, shavings and sawdust, tan bark, tormentilla root, mahogany, logwood, etc. These substances all contain more or less tannic acid, associated with soluble extractive and coloring matters. When they are introduced into the boiler, the soluble constituents are dissolved by the water, and basic tannate of lime is formed, which separates as a loose deposit, and does not adhere to the sides of the boiler. It is preferable to use the aqueous extract, as sawdust, chips, etc., are liable to find their way into the cocks and tubes, although they act mechanically, receiving incrustations which would otherwise fasten themselves on the sides of the boiler. In selecting one of these substances, the principal object is to secure the largest quantity of tannic acid and soluble extractive matter for the lowest price. Some of these substances are said to be very effective, ½ pound of catechu being sufficient for 100 cubic feet of water. From 4 to 6 pounds of oak chips have been recommended per horse power, or ½ bushel mahogany chips for every 10 horse power.

2331. Mucilaginous Substances as Preventives. Potatoes, starch, bran, linseed meal, gum, dextrine, Irish moss, slippery elm, marshmallow root, glue, etc. These substances form, sooner or later, a slimy liquid in the boiler, which prevents more or less completely the settling and hardening of the deposits. Some of them may even hold the lime and magnesia in solution. Potatoes have been used for many years, wherever steam engines are employed; half a peck or a peck are thrown into the boiler weekly. Linseed meal mixed with chopped straw was employed on a German railway, a peck at a time being introduced into each boiler. Some writers object to these organic substances, on the ground that they are liable to cause frothing.

2332. Saccharine Matter as Preventives. Sugar, molasses, corn or potato syrup. Both cane and grape sugar form soluble compounds with lime salts, and consequently prevent their separation as incrustations. One engineer found that 10 pounds of brown sugar protected his boiler for two months; another, that 6 pounds of corn starch syrup had a similar effect. Another used molasses with success, introducing a gallon at a time.

2333. Fatty Substances as Preventives. One writer used whale oil to prevent incrustations, 2 or 3 gallons at a time. Others smear the inside of the boiler with various mixtures of a fatty character. Stearine, mixed with wood ashes, charcoal and tar, has been recommended, or tallow, with soap and charcoal diluted with oil or tar, or tallow and graphite. This plan could not well be applied to a locomotive boiler with its numerous tubes, even though it should prove effective in cylinder boilers.

2334. Anti-Incrustation Powders, &c., for Boilers. Regarding incrustation powders in use, Professor Chandler makes the following suggestions and recommendations: Incrustation powders, bearing generally the names of their proprietors, are extensively advertised and sold; they are either worthless or are sold at such extravagant prices as to make their use extremely ill-advised. I have examined several of them. Those which are at all valuable consist of one or more of the substances already mentioned, and the only novel result of their use is the payment of many times the commercial value for a fair article. One which is put up in tin boxes, containing about one pound, at $2.50 each, contains carbonate of lime, 95.35 parts; carbonate of magnesia, 0.67 parts; and oxide of iron, 4.15 parts. It differs little from some of the incrustations in composition, and is of no value whatever. Another contains logwood, 75.00 parts; chloride of ammonia, 15.00 parts; chloride of barium, 10.00 parts. This is a very good article, but at the price for which it is sold it cannot be used in quantities sufficient to produce much effect. In fact, chloride of barium is too expensive to be used in this country at all.

2335. To Guard Against Incrustation in Boilers. Professor Chandler recommends the following precautions: The use of the purest waters that can be obtained, rain water wherever possible. Frequent use of the blow-off cock. That the boilers never be emptied while there is fire enough to harden the deposit. Frequent washing out. Experiments on the efficacy of zinc, lime-water, carbonate of soda, carbonate of baryta, chloride of ammonium, some substance containing tannic acid, linseed meal, and the electro-magnetic inductor.

2336. Management of the Water to Prevent Boiler Incrustation. Blowing off. The frequent blowing off of small quantities of water, say a few gallons at a time, is undoubtedly one of the most effective and simple methods for removing sediments and preventing their hardening on the sides of the boiler. The water entering the boiler should be directed in such a way as to sweep the loose particles toward the blow-off cocks, that when these are open they may be carried out with the water. This blowing off should take place at least two or three times daily, perhaps much oftener.

2337. Incrustation in Boilers. The only effectual remedy is to blow out frequently. Blow out once a week at least ten per cent. of the water in the boilers. It should be done while the water is at rest, that is, before starting in the feed water. A practical engineer says: Our boilers were badly incrusted. We loosened the scale with chisels and kerosene oil, and after running them a year as above, they came out as clean and bright as could be.

2338. Scale in Boilers. A practical engineer recommends the following: Get some cow or ox feet, just as they are cut off in the slaughter house, put them in a wire net fine enough to detain the small bones from getting from the boiler into the blow-off pipe. Use 5 of the feet to a 6-horse power boiler, and no further trouble with scale in the boilers will be experienced. They must be replaced every two or three months, according to the quality of the water. They do not make the water foam.

Glass. This is a compound of silica (silicic acid) with the oxide of an alkaline metal, obtained by fusion. In its usual form it is brittle, transparent, non-crystalline, insoluble, and fusible; but it sometimes exhibits other qualities. The principle of its production is very simple, although skill and experience are necessary to insure excellence. Silica (commonly under the form of sand) is heated with carbonate of potassa or soda and slaked lime or oxide of lead, until the mixture fuses and combination takes place. When the mass becomes perfectly limpid and free from air bubbles, it is allowed to cool until it assumes the peculiar tenacious condition for working. The fusion is performed in large crucibles of refractory fire-clay; in making lead glass, the crucible is covered with a dome, and an opening left in the side, through which the materials are put in and the melted glass withdrawn. Carbonates and other crystalline matter used in glass making, require to be *dry*. (*See No.* 2065.) Certain mineral oxides give glass a variety of color, sometimes of a very undesirable kind. Should the paste contain traces of iron, instead of producing white glass there will be only the common bottle-glass; and if the iron be in larger proportions, the dark green shade will be the result. On the contrary, add a certain quantity of oxide of lead to a pure base of potash, and the beautiful crystal glass is formed; a still larger dose, and the diamond paste, with its wonderfully dispersive power, will deceive many an unpracticed eye.

2340. Peligot's Bohemian Tube Glass. The component parts of this glass are 71½ parts quartz, 20 parts *dry* (*see No.* 2065) carbonate of potassa (or its equivalent), 8½ parts quicklime, and a little manganese. It is very intractable and difficult to melt, but the addition of a very small quantity of borax, boracic acid, or arsenious acid, causes it to flow into a glass of great brilliancy and hardness, and capable of being wrought at the highest heat of the ordinary furnace.

2341. Bottle Glass. *Dry* Glauber salts, 11 pounds; soaper salts, 12 pounds; ½ bushel of waste soap ashes; sand, 56 pounds; glass skimmings, 22 pounds; green broken glass, 1 cwt.; basalt, 25 pounds. This mixture affords a dark green glass. Or: Yellow or white sand, 100 parts; kelp, 30 to 40 parts; lixiviated wood ashes, from 160 to 170 parts; fresh wood ashes, 30 to 40 parts; potter's clay, 80 to 100 parts; cullet, or broken glass, 100 parts. If basalt be used, the proportion of kelp may be diminished.

2342. Broad, or Green Window Glass. *Dry* Glauber salts, 11 pounds; soaper salts, 10 pounds; ½ bushel of lixiviated soap waste; 50 pounds of sand; 22 pounds of glass-pot skimmings; 1 cwt. of broken green glass.

2343. Crown, or White Window Glass. Pure sand, 100 parts; dry sulphate of soda, 50 parts; dry quicklime, in powder, 17 to 20 parts; charcoal, 4 parts. The product is white and good.

2344. Bohemian Crown Glass. Pure silicious sand, 63 parts; potash, 22 parts; lime, 12 parts; oxide of manganese, 1 part.

2345. Nearly White Table Glass. Take 20 pounds potashes, 11 pounds dry Glauber salts, 16 pounds soaper salt, 55 pounds sand, and 140 pounds cullet or broken glass of the same kind. Or: 100 parts sand, 235 kelp, 60 wood ashes, 1⅛ manganese, 100 broken glass.

2346. White Table Glass. Fuse together 40 pounds potashes, 11 chalk, 76 sand, ½ part manganese, 95 white cullet. Or: 50 parts purified potashes, 100 sand, 20 chalk, and 2 saltpetre.

2347. Crystal Glass. Take 60 parts purified potashes, 120 sand, 24 chalk, 2 saltpetre, 2 arsenious acid, 1/10 part manganese. Or: Purified pearlashes, 70 parts; 120 white sand; 10 saltpetre; ½ part arsenious acid; and ⅛ part manganese. Or: 67 parts sand, 23 purified pearlashes, 10 sifted slacked lime, ¼ part manganese, 5 to 8 red lead.

2348. Clear Crystal Glass. White sand, 15 parts; red lead, 10 parts; refined ashes, 4 parts; nitre, 1 part; arsenious acid and manganese, of each a very little.

2349. Vienna Plate Glass. Sand, 100 parts; calcined sulphate of soda, 50 parts; lime, 20 parts; charcoal, 2¾ parts.

2350. Plate Glass. Pure sand, 40 parts; *dry* carbonate of soda, 26½ parts; lime, 4 parts; nitre, 1½ parts; broken plate glass, 25 parts.

2351. French Plate Glass. White quartz sand and cullet (old glass), of each 300 parts; *dry* carbonate of soda, 100 parts; slacked lime, 43 parts. Or: Pure sand, 72 parts; refined soda, 45 parts; quicklime, 48 parts; nitre, 2½ parts; cullet (old glass), 45 parts.

2352. Table of Proportions of the Materials Used for Making Lead Glass, the Numbers Increasing with the Quality.

	Crystal.					Common Flint.			Optical.		Paste to imitate Diamonds, &c.		
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
Silica	100	100	100	100	100	100	100	100	100	100	100	100	100
Oxide of Lead	10	30	42	45	48	66	70	80 to 85	100	100	133	154	160
Potash, purified	35	33	33	35	16	26	40	35 to 40	23	23	13	56	20
Saltpetre		10	15			7	3	2 to 3		1.3			20
Carbonate of Lime	13				8								
Borax									.7	1.8		6.3	

It has been suggested that the oxide, or other salt of thallium, substituted for the lead, makes a paste of greater brilliancy and dispersive powers for optical purposes, and for imitation gems.

2353. Ingredients for Coloring Paste to Imitate Gems. The following proportions must be added to 1000 parts of paste No. 12 in the above table of lead glass.

2354. For Topaz. Antimony glass, 40 parts; and 1 part gold purple (purple of cassius. *see Nos.* 2720 to 2723.)

2355. For Ruby. A ruby color is given by 25 parts oxide of manganese.

2356. For Amethyst. Oxide of manganese, 8 parts; ⅕ part gold purple (*see Nos.* 2720 to 2723), and 5 parts oxide of cobalt.

2357. For Garnet. Antimony glass, 500 parts; 4 parts oxide of manganese, and 4 parts gold purple. (*See Nos.* 2720 *to* 2723.)

2358. For Sapphire. Take 15 parts oxide of cobalt.

2359. For Aqua Marine. Take 7 parts antimony glass, ⅖ part oxide of cobalt.

2360. For Emerald. Take 8 parts oxide of copper, ⅕ part oxide of chrome.

2361. To Stain or Color Glass. Different colors are given to glass by the addition of metallic oxides. Thus, for *amethyst*, oxide of manganese is used; for *blue*, oxide of cobalt; for *brown*, oxide of iron; for *green*, black oxide of copper; for *purple*, oxide of gold; for *ruby red*, suboxide of copper; for *white*, oxide of tin; for *yellow*, oxide of silver, &c. These substances are either added to the melted contents of the glass-pot, as in preparing artificial gems (*see No.* 2419), or are applied in a thin layer to the surface of the object, which is then heated until the coloring compound fuses as in enameling. (*See No.* 2378.)

2362. French Glass Used for Light-Houses. The special composition of the crown glass used for the light apparatus for light-houses was, until quite recently, kept a secret by the manufacturers of Saint Gobain, in France, and some firms in Birmingham, which had the monopoly of this branch of trade. From the researches of David M. Henderson, C. E., we are able to furnish the composition of both. The French glass is composed of silicic acid, 72.1 parts; soda, 12.2 parts; and lime, 15.7 parts; including some traces of alumina and oxide of iron.

2363. English Light-House Glass. In Birmingham it is made from 560 pounds French sand, 203 pounds carbonate of soda, 63 pounds lime, 28 pounds nitrate of soda, and 3 pounds arsenious acid. The best qualities of this glass are at present produced in the Siemens furnace.

2364. Liquid Spectroscopes. The use of transparent liquids, such as bisulphide of carbon, for the manufacture of lenses, is making rapid progress on the ground of economy; large pieces of glass, free from flaw and blemish, being difficult to obtain, and expensive. Poggendorff's "Annalen" calls attention to possible disturbances of the accuracy of liquid prisms, the lines in the spectrum varying with the temperature. The divergence, owing to changes of heat and cold, of the lines of solid prisms, is quite insignificant. A glass prism, heated in the sun and then removed to the shade, was observed to possess an increased refractive power as it cooled, while a bisulphide prism exhibited a reversed result. These facts point out the importance of the use of the thermometer in conjunction with the spectroscope, and also show that there is room for great improvement in the manufacture of glass for optical purposes.

2365. Prismatic Diamond Crystals for Windows. A hot solution of sulphate of magnesia, and a clear solution of gum-arabic, mixed together. Lay it on hot. For a margin or for figures, wipe off the part you wish to remain clear with a wet towel.

2366. To Drill Glass. Wet an ordinary drill with petroleum or benzine; turpentine will answer, but not so well; it will then bore common glass nearly as rapidly as steel. If it is intended to bore through, the glass should be first countersunk on each side with a drill dressed off so as to form a very flat three-sided pyramid. Flint and plate-glass are very difficult to bore. It has been recently ascertained that dilute sulphuric acid is much more effective, with less wear of the tool, than oil of turpentine. It is stated that at Berlin, glass castings for pump barrels etc., are drilled, planed and bored like iron ones, and in the same lathes and machines, by the aid of sulphuric acid.

2367. To Cut Glass Round or Oval Without a Diamond. Scratch the glass around the shape you desire with the corner of a file or graver; then, having bent a piece of wire to the same shape, heat it red hot and lay it upon the scratch, sink the glass into cold water just deep enough for the water to come almost on a level with its upper surface.

2368. To Break Glass in any Required Way. Dip a piece of worsted thread in spirits of turpentine, wrap it round the glass in the direction required to be broken, and then set fire to the thread, or apply a red hot wire round the glass; if it does not immediately crack, throw cold water on it while the wire remains hot. By this means glass vessels that have been broken may often be fashioned and rendered useful for a variety of purposes.

2369. To Break a Glass Bottle or Jar Across its Circumference. Place the bottle in a vessel of water, to the height where it is designed to break it; also fill the bottle to the same level. Now pour coal oil inside and out on the water; cut a ring of paper, fitting the bottle. Saturate with alcohol or benzine, so that it touches the oil. Pour, also, some inside the bottle. Set on fire; the cold water prevents the glass from heating below its surface, while the expansion caused by the heat will break the vessel on the water line.

2370. Glass of Antimony. Roast powdered antimony in a shallow vessel over a gentle fire, until it turns whitish gray, and ceases to emit fumes at a red heat; then heat it in a crucible until it fuses into a brownish red glass. If calcined too much, a little more antimony must be added to make it run well.

2371. Writing on Glass. This may be done with a piece of French chalk, or crayons prepared for the purpose; or even with a common pen held nearly perpendicular. India ink, or, when the article will be exposed to damp, shellac varnish, thickened with a little vermilion or lampblack, for red or black color, is best adapted for the purpose. Common ink is not sufficiently opaque.

2372. To Imitate Ground Glass. A ready way of imitating ground glass is to dissolve Epsom salts in beer, and apply with a brush. As it dries it crystallizes.

2373. To Make Prince Rupert's Drops. Prince Rupert's drops are made by letting drops of melted glass fall into cold water; the drops assume by that means an oval form, with a tail or neck resembling a retort. They possess this singular property, that if a small portion of the tail is broken off, the whole bursts into powder, with an explosion, and a considerable shock is communicated to the hand that grasps it.

2374. To Etch on Glass. Etching with hydrofluoric acid on plate glass is practiced now to a very considerable extent, the French manufacturers especially producing splendid ornamental effects by this process. The drawings to be imitated or etched on the glass are first made on stone or plate and then printed on unsized paper with an ink consisting principally of a solution of asphaltum in oil of turpentine made with the aid of heat, to which some substance is added which shows a more or less crystalline structure on cooling, as stearic acid, spermaceti, naphthaline, paraffine. This mixture is strained and rapidly cooled with constant stirring; it is the only kind of coating which thoroughly resists the action of the corrosive acid. The printed paper is laid flat with the blank side on water, to which from 10 to 25 per cent. of muriatic acid has been added, and as soon as the lines show signs of softening the negative printing is transferred to the glass by a slight pressure; when the paper is removed, the picture will adhere to the glass, and this is afterwards exposed to the fluoric vapors in leaden troughs.

2375. To Etch or Write on Glass. A writer in Dingler's "Polytechnisches Journal" recommends a solution of fluoride of ammonium, which can be used with an ordinary quill, and on drying leaves a distinct line.

2376. To Engrave on Glass. To engrave on glass, fluoric acid is used, either in the liquid state or in vapor. This acid is kept in metal bottles, and requires very careful handling. The glass must be warmed, and coated with wax, or engravers' cement, and the writing or design traced through the wax with a pointed instrument. The liquid fluoric acid is poured on it, and left to act on the uncovered portions of the glass; or pour some of the acid in a small lead pan, which place in a still larger vessel filled with sand; heat the sand and place the glass object over the gas liberated from the heated acid, and it will soon be found to be beautifully etched. Great care must be taken when this is going on, for the gas, as well as the acid, is of a very deleterious character. The same effect may be produced by the use of fluorspar, powdered and made into a paste with oil of vitriol, laid over the prepared surface, and covered with lead-foil or tea-lead; or bruised fluorspar is put in a wedgwood evaporating basin, with sufficient oil of vitriol to form a thin paste, and the prepared glass laid over the basin, so that the vapors may act on the portions from which the wax has been removed.

2377. Glass of Borax. Calcine borax with a strong heat till the water of crystallization is expelled, and the salt fuses into a clear glass.

Enamels.

A species of vitreous varnish, colored by means of metallic oxides (*see No.* 2393) and applied in a thin stratum to brightly polished metallic surfaces (copper or gold), on which it is fused by the flame of a blowpipe, or by the heat of a small furnace. The basis of all enamels is a highly transparent and fusible glass, called *frit, flux,* or *paste.*

2379. Base Frit or Flux for Enamels. The precise qualities of the products of the following processes depend greatly upon the duration and degree of heat employed. By increasing the quantity of sand, glass, or flux, the enamel is rendered more fusible, and the opacity and whiteness is increased by the addition of oxide of tin. The use of borax should be avoided, or used very sparingly, as it is apt to make the enamel effloresce and lose color.

I. Red lead, 16 parts; calcined borax, 3 parts; powdered flint glass, 12 parts; powdered flints, 4 parts; fuse in a Hessian crucible for 12 hours, then pour it out into water, and reduce it to a powder in a biscuit-ware (unglazed porcelain) mortar.

II. Powdered flints, 10 parts; nitre and white arsenic, of each 1 part as last.

III. Flint glass, 3 ounces; red lead, 1 ounce; as last.

IV. Red lead, 18 parts; borax (not calcined), 11 parts; flint glass, 16 parts; as last.

V. Flint glass, 6 parts; flux No. II, above, 4 parts; red lead, 8 parts; as last.

VI. Tin, 2 to 5 parts; lead, 10 parts; calcine in an iron pot at a dull cherry-red heat, and scrape off the oxide as it forms, observing to obtain it quite free from undecomposed metal; when enough of the dross is obtained, reduce it to fine powder by grinding and elutriation (*see No.* 14), then mix 4 parts of this powder with an equal weight of pure sand or powdered flints, and 1 of sea-salt, or other alkaline matter; fuse the mixture in a Hessian crucible, and proceed as before. The best proportions of the tin and lead, for all ordinary purposes, are about 3 of the former to 10 of the latter. The calcined mixed oxides are commonly called calcine.

VII. Lead and tin, equal parts; calcine as above; and take of the mixed oxides, or calcine (*see preceding receipt*) and ground flints, of each 1 part; pure subcarbonate of potash, 2 parts; as before.

VIII. Lead, 30 parts; tin, 33 parts; calcine as before, then mix 50 parts of the calcine with an equal weight of flints, in powder, and 1 pound of salts of tartar; as before. A fine dead white enamel.

2380. Black Enamels. I. Pure clay, 3 parts; protoxide of iron, 1 part; mix and fuse. A fine black.

II. Calcined iron (protoxide), 12 parts; oxide of cobalt, 1 part; mix, and add an equal weight of white flux. (*See No.* 2396.)

III. Peroxide of manganese, 3 parts; zaffre, 1 part; mix and add it as required to white flux. Zaffre is crude oxide of cobalt.

2381. Blue Enamels. Either of the white fluxes colored with oxide of cobalt.

II. Sand, red lead, and nitre, of each 10 parts; flint glass or ground flints, 20 parts; oxide of cobalt, 1 part, more or less, the quantity depending on the depth of color required.

2382. Brown Enamels. I. Red lead and calcined iron, of each 1 part; antimony, litharge, and sand, of each 2 parts; mix and add it in any required proportion to a flux, according to the color desired. A little oxide of cobalt or zaffre is frequently added, and alters the shade of brown.

II. Manganese, 5 parts; red lead, 16 parts; flint powder, 8 parts; mix.

III. Manganese, 9 parts; red lead, 34 parts; flint powder, 16 parts.

2383. Green Enamels. I. Flux, 2 pounds; black oxide of copper, 1 ounce; red oxide of iron, ½ drachm; mix.

II. As above, but use the red oxide of copper. Less decisive.

III. Copper dust and litharge, of each 2 ounces; nitre, 1 ounce; sand, 4 ounces; flux, as much as required.

IV. Add oxide of chrome to a sufficient quantity of flux to produce the desired shade; when well managed the color is superb, and will stand a very great heat; but in careless hands, it frequently turns on the dead-leaf tinge.

V. Transparent flux, 5 ounces; black oxide of copper, 2 scruples; oxide of chrome, 2 grains. Resembles the emerald.

VI. Mix blue and yellow enamel in the required proportions.

2384. Olive Enamels. Good blue enamel, 2 parts; black and yellow enamels, of each 1 part; mix. (*See Brown Enamels.*)

2385. Orange Enamels. I. Red lead, 12 parts; red sulphate of iron and oxide of antimony, of each 1 part; flint powder, 3 parts; calcine, powder, and melt with flux, 50 parts.

II. Red lead, 12 parts; oxide of antimony, 4 parts; flint powder, 3 parts; red sulphate of iron, 1 part; calcine, then add flux, 5 parts to every 2 parts of this mixture.

2386. Purple Enamels. I. Flux colored with oxide of gold, purple precipitate of cassius (*see Nos.* 2720 to 2723), or peroxide of manganese.

II. Sulphur, nitre, vitriol, antimony, and oxide of tin, of each 1 pound; red lead, 60 pounds; mix and fuse, cool and powder; add rose copper, 19 ounces; zaffre, 1 ounce; crocus martis, 1½ ounces; borax, 3 ounces; and 1 pound of a compound formed of gold, silver, and mercury; fuse, stirring the melted mass with a copper rod all the time, then place it in crucibles, and submit them to the action of a reverberatory furnace for 24 hours. This is said to be the purple enamel used in the mosaic pictures of St. Peter's at Rome.

2387. Dark Red Enamel. Sulphate of iron (calcined dark), 1 part; a mixture of 6 parts of flux IV. (*in No.* 2379) and 1 of colcothar, 3 parts.

2388. Light Red Enamel. Red sulphate of iron, 2 parts; flux I (*in No.* 2379) 6 parts; white lead, 3 parts. Light red.

2389. Red Enamel. Paste or flux colored with the red or protoxide of copper. Should the color pass into the green or brown, from the partial peroxidizement of the copper, from the heat being raised too high, the red color may be restored by the addition of any carbonaceous matter, as tallow, or charcoal.

2390. Beautiful Red Enamel. The most beautiful and costly red, inclining to the purple tinge, is produced by tinging glass or flux with the oxide or salts of gold, or with the purple precipitate of cassius (*see Nos.* 2720 *to* 2723), which consists of gold and tin. In the hands of the skillful artist, any of these substances produce shades of red of the most exquisite hue; when most perfect, the enamel comes from the fire quite colorless, and afterwards receives its rich hue from the flame of the blow-pipe.

2391. Rose Colored Enamels. Purple enamel, or its elements, 3 parts; flux, 90 parts; mix, and add silver-leaf or oxide of silver, 1 part or less.

2392. Transparent Enamels. Either of the first five fluxes in No. 2379.

2393. Violet Enamels. Saline or alkaline frits or fluxes colored with small quantities of peroxide of manganese. As the color depends on the metal being at the maximum of oxidation, contact with all substances that would abstract any of its oxygen should be avoided. The same remarks apply to other metallic oxides.

2394. Yellow Enamels. Superior yellow enamels are less easily produced than most other colors; they require but little flux, and that mostly of a metallic nature. I. Red lead, 8 ounces; oxide of antimony and tin, calcined together, each 1 ounce; mix, and add flux IV. (*in No.* 2379), 15 ounces; mix and fuse. By varying the proportion of the ingredients, various shades may be produced.

II. Lead, tin ashes, litharge, antimony, and sand, each 1 ounce; nitre, 4 ounces; mix, fuse, and powder, and add the product to any quantity of flux, according to the color required.

III. Flux fused with oxide of lead, and a little red oxide of iron.

IV. Pure oxide of silver added to the metallic fluxes. The salts of silver are also used, but are difficult to manage. If a thin film of oxide of silver be spread over the surface of the enamel to be colored, exposed to a moderate heat, then withdrawn, and the film of reduced silver on the surface removed, the part under will be found tinged of a fine yellow.

2395. Bright Yellow Enamel. White oxide of antimony, alum, and sal ammoniac, each 1 part; pure carbonate of lead, 1 to 3 parts, as required, all in powder; mix, and expose to a heat sufficiently high to decompose the sal ammoniac.

2396. Dead-White Enamel. For white enamel, the articles must be perfectly free from foreign admixture, as this would impart a color. When well managed, either of the following forms will produce a paste that will rival the opal. Calcine (from 2 parts of tin and 1 part of lead calcined together), 1 part; fine crystal or frit, 2 parts; a very trifling quantity of manganese; powder, mix, melt, and pour the fused mass into clean water; dry, powder, and again fuse, and repeat the whole process 3 or 4 times, observing to avoid contamination with smoke, dirt, or oxide of iron.

2397. Fine White Enamel. Washed diaphoretic antimony, 1 part; fine glass (perfectly free from lead), 3 parts; mix, and proceed as before.

2398. To Make Black Enamel for Gold or Silver. Melt together in a crucible, 1 part, by weight, of silver, 5 parts copper, 7 parts lead, and 5 parts muriate of ammonia. Add to this mixture twice its quantity of pulverized sulphur, covering the crucible immediately. Let it calcine until the excess of sulphur has passed off. Then pound the compound to coarse powder and make it into a paste with a solution of muriate of ammonia. This is the black enamel used for jewelry.

2399. To Black Enamel Gold or Silver. Place some of the enamel paste, as prepared in the preceding receipt, on the article to be enameled; hold it over a spirit lamp until the enamel melts and flows upon it. It may then be smoothed and polished.

2400. Black or Enameled Copper. The beautiful enameled surface possessed by paintings on copper, may be produced, on a black ground, by the following process: Clean the copper with sand and sulphuric acid, and then apply the following mixture: 2 parts white arsenic, 4 parts hydrochloric acid, 1 sulphuric acid, and 24 water.

2401. Enamel for Labels, Signboards, etc. The fine enamels of trade are generally prepared by fusing at high temperatures, silica, oxide of tin, and oxide of lead, and spreading the mixture over the surface of a sheet of copper, gold, or platinum. The objections to these enamels are, in the first place their high cost, and secondly the impossibility of giving them a perfectly flat surface. Mr. E. Duchemin has advantageously replaced them by the following economical and efficient compound:

2402. Duchemin's Enamel for Labels, etc. Arsenic, 30 parts by weight; saltpetre, 30 parts; silica (fine sand), 90 parts; litharge, 250 parts. This is spread on plates of glass of the required shape and size, care being taken, however, that the kind of glass employed be not inferior in point of fusibility to the enamel. Enameled glass prepared from the above substances may be drawn or written on as readily as if it were paper, and in less time than one minute the writing may be rendered indelible by simply heating the plate in a small open furnace or muffle. Drawings, autographs, legal acts, public documents, historical facts and dates of importance, labels for horticultural purposes or destined for out-of-door exposure, coffin plates, signboards, show-case signs, etc., may thus be cheaply made, which will resist atmospheric influences for ages. First-class photographs, either positives or negatives, may be taken on such enamels without collodion. (*See Photographs on Enamel.*)

2403. Enamel for Iron Hollow Ware. The enamel of iron hollow ware is made of powdered flints, ground with calcined borax, fine clay, and a little feldspar. This mixture is made into a paste with water and brushed over the pots after they have been scoured with diluted sulphuric acid and rinsed clean with water. While still moist they are dusted over with a glaze composed of feldspar, carbonate of sodium, borax, and a little oxide of tin. Thus prepared, the pots are gradually dried and then the glaze is fired or fused under a muffle at a bright red heat. Oxide of lead, although increasing the fusibility of the glaze, impairs its efficiency, as it will not resist the action of acids in cooking.

Glazes.

Glazes must be reduced to a very fine powder. For use they are ground with water to a very thin paste or smooth cream, into which the articles, previously baked to the state called "*biscuit,*" are then dropped; they are afterwards exposed to a sufficient heat in the kiln to fuse the glaze. Another method of applying them is to immerse the *biscuit* in water for a minute or so, and then to sprinkle the dry powder over the moistened surface.

2405. White Glazing. Prepare an intimate mixture of 4 parts massicot (*see Index*), 2 parts tin ashes, 3 of crystal glass fragments, and ½ part sea salt. The mixture is suffered to melt in earthenware vessels, when the liquid flux may be made use of.

2406. Yellow Glazing. Take equal parts of massicot, red lead, and sulphuret of antimony. Calcine the mixture and reduce it again to powder, add then 2 parts of pure sand and 1½ parts of salt. Melt the whole.

2407. Green Glazing. Sand, 2 parts; 3 parts massicot, 1 part of salt and copper scales, according to the shade to be produced. The mixture is melted as directed above.

2408. Violet Glazing. Massicot, 1 part; 3 parts sand, 1 of smalt, and ⅛ part black oxide of manganese.

2409. Blue Glazing. White sand and massicot, equal parts, ⅛ part of blue smalt.

2410. Black Glazing. Black oxide of manganese, 2 parts; 1 of smalt, 1½ of burned quartz, and 1½ massicot.

2411. Brown Glazing. Take 1 part broken green bottle glass, 1 of manganese, and 2 parts lead glass.

2412. Glaze without Lead. Common earthenware is glazed with a composition containing lead, on which account it is unfit for many purposes. The following glaze has been proposed, among others, as a substitute: 100 parts washed sand, 80 parts purified potash, 10 of nitre, and 20 of slacked lime, all well mixed, and heated in a black-lead crucible, in a reverberatory furnace, till the mass flows into a clear glass. It is then to be reduced to powder. The goods to be slightly burnt, dipped in water, and sprinkled with the powder.

2413. Glaze for Porcelain. Feldspar, 27 parts; borax, 18 parts; Lynn sand, 4 parts; nitre, 3 parts; soda, 3 parts; Cornwall china-clay, 3 parts. Melt together to form a frit, and reduce it to a powder with 3 parts calcined borax.

2414. Metallic Lustres for Pottery. The appearance of a lustrous metallic surface is given to vessels of stoneware, &c., by applying the lustre over an easily-fusible glaze to the outer surface of the vessel, after which adhesure is produced by exposing it to a slight degree of heat. They are then polished with cotton or leather. The principal lustres are given in the following receipts:

2415. Gold Lustre. Dissolve 1 drachm grain-gold in ¾ ounce aqua-regia, add 6 grains metallic tin to the solution. When dissolved, pour it gradually, with constant stirring, into a mixture of ½ drachm balsam of sulphur, (*see Index*), and 20 grains oil of turpentine. When the mass begins to stiffen, an additional ½ drachm oil of turpentine must be added and well mixed in. More gold deepens and brightens the lustre; more tin turns it on the violet or purple. Applied as in No. 2414.

2416. Iron Lustre. This is a mixture of muriate of iron and spirit of tar. Used according to No. 2414.

2417. Platinum Lustre. To bichloride of platinum (a solution of platina in aqua-regia), is added drop by drop a mixture of spirit of tar and balsam of sulphur in equal proportions, until by a trial the composition is found to give the required result. This gives the appearance of polished steel. (*See No.* 2414.)

2418. Silver Lustre. Reduce ammonio-chloride of platinum to an impalpable powder; grind it to the requisite consistence with a little spirit of tar, and apply with a brush as directed in No. 2414.

Artificial Gems.

These consist of vitreous compounds made in imitation of gems and precious stones. Like enamels, the artificial gems have for their basis a very fusible, highly transparent and brilliant dense glass, which is known under the name of *frit, paste, strass, mayence base,* &c., and which, in its state of greatest excellence, consitutes the artificial diamond. As the strass or base enters largely into the manufacture of imitation gems, we give the method for making it first. It is absolutely necessary, to ensure success in the following receipts, that the substances employed be perfectly free from impurities, particularly those of a mineral nature. Litharge, oxide of lead, and carbonate of lead especially, must be entirely free from oxide of tin, as the smallest particle of this imparts milkiness to the paste. All the ingredients must be separately reduced to powder; and, after being mixed, sifted through lawn. For the finer kinds of mock diamonds, rock crystal should alone be employed; when sand is used, the purest white variety should be selected, and be washed thoroughly, first with muriatic acid and then with water, to remove any traces of earthy matter. Much of the minute detail in making artificial gems can only be acquired by experience. The fusion must be carefully conducted and continuous, and the melted mass allowed to cool very slowly, after having been left in the fire for 24 to 30 hours at least. Hessian crucibles are preferred for this purpose, and the heat of an ordinary porcelain kiln is usually sufficient; but a small wind-furnace, devoted exclusively to the purpose, is in general more convenient. It is found that the more tranquil, continuous and uniform the fusion, the denser and clearer is the paste, and the greater its refractive power and beauty. All the colored vitreous compounds noticed as enamels (*see No.* 2378, *&c.*) may be worked up in this way into ornamental stones. It may be further observed that the beauty of pastes or imitation gems, and especially the brilliancy of mock diamonds, is greatly dependent on the cutting, setting up, and the skillful arrangement of the foil or tinsel behind them. (*See* ENAMELS, *No.* 2378, *&c.;* FOILS, *No.* 2447, *&c.*)

2420. Diamond Paste, or Strass. Litharge, 20 parts; silica, 12 parts; nitre and borax, each 4 parts; white arsenic, 2 parts; powder mix, fuse in a crucible, pour the melted mass into water, separate any reduced lead, and again powder and re-melt.

2421. Mayence Base, or Strass. Silica (quartz, flint or rock crystal), 8 ounces; salt of tartar, 24 ounces; mix, bake, cool, wash with dilute nitric acid, and afterwards with water; dry, powder, add 12 ounces pure carbonate of lead, and to every 12 ounces of the mixture add borax, 1 ounce; triturate in a porcelain mortar, melt in a clean crucible, and pour the fused compound into cold water; dry, powder, and repeat the process a second and a third time in a clean crucible, observing to separate any revived lead. To the third frit add nitre, 5 drachms, and again melt. Very brilliant. Or: Carbonate of lead, 8 ounces; powdered borax, 2 ounces; rock crystal, 3 ounces; manganese, ½ grain; mix, and proceed as last.

2422. Patent Base for Artificial Gems. The base of these gems, as patented by the Superintendent of the Royal Porcelain Works at Berlin, is a flux obtained by melting together 6 drachms carbonate of soda, 2 drachms burnt borax, 1 drachm saltpetre, 3 drachms minium, and 1½ ounces purest white sand.

2423. Loysel's Strass or Paste. Pure silex (flint or quartz), 100 parts; red oxide of lead (minium), 150 parts; calcined potash, 30 to 35 parts; calcined borax, 10 parts; arsenious acid, 1 part. This produces a paste which has great brilliancy and refractive and dispersive powers, and also a similar specific gravity to the oriental diamond. It fuses at a moderate heat, and acquires the greatest brilliancy when re-melted, and kept for 2 or 3 days in a fused state, in order to expel the superabundant alkali, and perfect the refining.

2424. Fontanier's Base for Artificial Gems. Mix together 8 ounces pure silica and 24 ounces salt of tartar; bake, cool, wash with dilute nitric acid, and afterwards with water; dry, powder, add 12 ounces pure carbonate of lead, and to every 12 ounces of the mixture add borax, 1 ounce; triturate in a porcelain mortar, melt in a clean crucible, and pour the fused compound into cold water; dry, powder, and repeat the process a second and a third time in a clean crucible, observing to separate any revived lead. To the third frit add nitre, 5 drachms, and again melt. The product is perfectly limpid and extremely brilliant.

2425. Doualt-Wiéland's Paste or Strass. Rock crystal, 4056 grains; minium, 6300 grains; potash, 2154 grains; borax, 276 grains; arsenic, 12 grains. Or: Sand, 3600 grains; pure carbonate of lead, 8508 grains; potash, 1260 grains; borax, 360 grains; arsenic, 12 grains.

2426. Lançon's Paste or Strass. Litharge, 100 grains; silex, 75 grains; white tartar or potash, 10 grains.

2427. Red Cornelian. Strass, 2 pounds; glass of antimony, 1 pound; calcined peroxide of iron (rouge), 2 ounces; manganese, 1 drachm.

2428. White Cornelian. Strass, 2 pounds; washed yellow ochre, 2 drachms; calcined bones, 1 ounce.

2429. Oriental Garnet or Carbuncle. Fuse 512 grains paste, 256 grains glass of antimony, 2 grains purple of cassius, and 2 grains oxide of manganese. Or: 359 grains paste, 178 grains glass of antimony, and 2 grains oxide of manganese.

2430. Vinegar Garnet. Take 2 pounds paste, 1 pound glass of antimony, and ½ ounce oxide of iron.

2431. Opal. Take 1 ounce paste, 10 grains horn silver, 2 grains calcined magnetic ore, 26 grains calcined bones. Or: 10 pounds paste, and ½ pound calcined bones.

2432. Ruby. Take 40 parts paste, and 1 part oxide of manganese. Or: 1 part topaz paste that has turned out opaque, and 8 parts strass; fuse for 30 hours, cool, and fuse small pieces before a blow-pipe. Or: 8 ounces strass, 84 grains each precipitate of cassius (*see Nos.* 2720 *to* 2723), peroxide of iron, golden sulphuret of antimony, and manganese calcined with nitre; add 1 ounce or more of rock crystal. Or: 1 pound paste and 3 drachms purple of cassius. Or: 4 ounces paste, 4 ounces glass of antimony, and ¾ drachm purple of cassius; this turns on the orange.

2433. Sapphire. Fuse 1152 parts paste and 68 parts oxide of cobalt for 30 hours in a luted Hessian crucible. Or: 8 ounces paste and 49 grains oxide of cobalt. A little manganese may be added to this last receipt.

2434. Topaz. Melt 96 grains paste and 1 grain calcined peroxide of iron. Or: 1008 grains paste, 43 grains glass of antimony, and 1 grain purple of cassius. (*See Nos.* 2720 *to* 2723.)

2435. Turquois. Take 10 pounds blue paste, ½ pound calcined bones.

2436. Yellow Diamond. Take 1 ounce strass, and 10 grains glass of antimony. Or: 1 ounce strass and 24 grains chloride of silver.

2437. Chrysolite. Strass, 5 pounds; calcined peroxide of iron, 3 to 4 drachms.

2438. Eagle Marine. Paste of strass, 10 pounds; copper highly calcined with sulphur (copper-stain), 3 ounces; zaffre, 1 scruple.

2439. Emerald. Lançon's paste (*see No.* 2426), 9612 grains; acetate of copper, 72 grains; peroxide of iron, 1½ grains. Or: Doualt-Wiéland paste (*see No.* 2425), 4608 grains; green oxide of copper, 42 grains; oxide of chrome, 2 grains. Or: Paste, 1 ounce; glass of antimony, 20 grains; oxide of cobalt, 3 grains. Or: Paste, 15 ounces; carbonate of copper, 1 drachm; glass of antimony, 6 grains.

2440. Lapis Lazuli. Paste, 10 pounds; calcined horn or bones, 12 ounces; oxides of cobalt and manganese, of each, ½ ounce; mix. The golden veins are produced by painting them on with a mixture of gold powder, borax, and gum water, and gently heating till the borax fluxes.

2441. Amethyst. Take 500 grains paste, 3 grains oxide of manganese, and 2 grains oxide of cobalt. Or: 4608 grains paste, 36 grains oxide of manganese, 24 grains oxide of cobalt, and 1 grain purple of cassuis. (*See Nos.* 2720 *to* 2723.) Or: 9216 grains paste, 15 to 24 grains oxide of manganese, and 1 grain oxide of cobalt.

2442. Aqua Marina, or Beryl. Take 3200 grains paste, 20 grains glass of antimony, and 1 grain oxide of cobalt. Or: 2304 grains paste, 16 grains glass of antimony, and 1 grain oxide of cobalt.

2443. Aventurine, or Gold Stone. Fuse 10 grains scales of iron, 50 grains paste, and 5 grains protoxide of copper, until the copper is reduced to metallic form, then allow the mass to cool very slowly, so that the minute crystals of metal become equally diffused through it. By substituting oxide of chromium for the protoxide of copper, the stone appears brown, filled with minute gold spangles; or by using a less quantity of the chromium, a greenish gray stone, filled with green spangles, is produced.

2444. Parisian Diamonds. These beautiful imitations of the gem are merely fused oxide of tin. It is a pity that their brilliancy is not permanent, as they become quite dull in time.

2445. Boettger's Artificial Rubies. Moisten recently precipitated and well washed hydrate of alumina, with a few drops of neutral chromate of potassa, and kneaded so that the mass assumes a scarcely perceptible tinge; then roll it out into small sticks, about the thickness of a finger, and dry them slowly, filling up any cracks that may occur in drying with fresh hydrate of alumina. When perfectly dry, warm a stick a little, and bring a portion into the end of the flame of a compound (oxyhydrogen) blow-pipe. In a few minutes several minute balls form, of such intense hardness as to scratch quartz, glass, and granite. These, however, when cut and polished, appear slightly opaque.

2446. Boettger's Artificial Emerald. This is made in the same manner as his rubies, by employing nitrate of nickel instead of the chromate of potassa. The same plan, substituting oxide of chromium for chromate of potassa, will produce gems of considerable hardness and beauty, though slightly opaque; which may, however, be lessened by the addition of a very little silica.

Foils.

These are leaves of polished metal, put under stones or pastes, to heighten the effect. Foils were formerly made of copper, tinned copper, tin, and silvered copper, but the latter is used for superior work at the present day. There are two descriptions of foils employed, viz.: white, for diamonds and mock diamonds, and colored, for the colored gems. The latter are prepared by varnishing the former. By their judicious use the color of a stone may be often modified. Thus, by placing a yellow foil under a green stone that turns too much on the blue, or a red one turning too much on the crimson, the hues will be brightened. By the skillful use of the following varnishes, good imitations of the gems may be cheaply made from transparent white glass or paste, and when applied to foils set under colored pastes, (factitious gems), a superior effect may be produced. The colors must be reduced to the finest state possible by patient grinding, as without this precaution, transparent and beautiful shades cannot be formed. The palest and cleanest mastich, and lac dissolved in alcohol, and also the palest and quickest drying oil, should alone be employed, when these substances are ordered. In every case the colors must be laid on the foils with a broad soft brush, and the operation should be performed, if possible, at once, as no part should be crossed, or twice gone over while wet.

2448. White or Common Foil. This is made by coating a plate of copper with a layer of silver, and then rolling it into sheets in the flatting mill. The foil is then highly polished or varnished.

2449. Colored Foils. These are made by coloring the preceding foil, highly polished, with certain transparent solutions or varnishes. The following produce beautiful colored effects, when judiciously employed.

2450. Blue Foil. Prussian blue, ground with pale, quick-drying oil. Used to deepen the color of sapphires. It may be diluted with oil.

2451. Green Foil. Pale shellac, dissolved in alcohol (lacquer), and tinged green by dissolving verdigris or acetate of copper in it. Or: Sesquiferrocyanuret of iron and bichromate of potassa, of each ½ ounce; grind them with a stone and muller to a fine powder, add gum mastich (clean and also in fine powder), 2 ounces; grind again, add a little pyroxilic spirit, and again grind until the mass becomes homogeneous and of a fine transparent green; the beauty increases with the length of the grinding. The predominance of the bichromate turns it on the yellowish green; that of the salt of iron, on the bluish green. For use it is to be thinned with pyroxilic spirit. This is used for emeralds. It may be brightened by adding a little yellow varnish.

2452. Yellow Foil. Various shades of yellow may be produced by tinging a weak alcoholic solution of shellac or mastich, by digesting turmeric, annotto, saffron, or socotrine aloes therein. The former is the brightest and most fit for topazes. Or: Digest hay saffron in 5 or 6 times its weight of boiling water, until the latter becomes sufficiently colored; filter, and add a little solution of gum or isinglass. When dry, a coating of spirit varnish should be applied.

2453. Red Foil. Carmine dissolved in spirits of hartshorn, or a weak solution of salt of tartar, and gum added as above.

2454. Garnet Foil. Dragon's blood dissolved in rectified spirit of wine. (*See No.* 2449.)

2455. Vinegar Garnet Foil. White foil (*see No.* 2449) varnished with orange lake finely tempered with shellac varnish.

2456. Amethyst Foil. Lake and Prussian blue, ground fine in pale drying oil.

2457. Eagle Marine Foil. Verdigris tempered in shellac varnish (alcoholic), with a little Prussian blue. With this varnish white foil. (*See No.* 2449.)

2458. Ruby Foil. Lake or carmine, ground in isinglass. Or: Lake ground in shellac varnish. Used when the color turns on the purple. Or: Bright lake ground in oil; used when the color turns on the scarlet or orange. Either of these are applied to white foil. (*See No.* 2449.)

2459. To Make an Imitation Diamond more Brilliant. Cover the inside of the socket in which the stone or paste is to be set with tin foil, by means of a little stiff gum or size; when dry, polish the surface, heat the socket, fill it with warm quicksilver, let it rest for 2 or 3 minutes, after which pour it out and gently fit in the stone; lastly, well close the work round the stone, to prevent the alloy being shaken out. Or: Coat the bottom of the stone with a film of real silver, by precipitating it from a solution of the nitrate in spirits of ammonia, by means of the oils of cassia and cloves. (*See* SILVERING GLASS.) Both these methods vastly increase the brilliancy both of real and factitious gems.

Inks. Writing inks might be included under the general term of liquid coloring matters, were it not that they require to have the special characteristics of brilliance, permanence, and some degree of indestructibility, combined with perfect fluidity, in order to fulfill the objects for which they are generally used. Printing and lithographic and other inks are also included under this heading.

2461. Black Ink. According to the most accurate experiments on the preparation of black ink, it appears that the quantity of sulphate of iron should not exceed ⅛ part of that of the galls, by which an excess of coloring matter, which is necessary for the durability of the black, is preserved in the liquid. Gum, by shielding the writing from the action of the air, tends to preserve the color, but if much is employed, the ink flows badly from quill pens, and scarcely at all from steel pens. The latter require a very limpid ink. The addition of sugar increases the flowing property of ink, but makes it dry more slowly, and frequently passes into vinegar, when it acts injuriously on the pen. Vinegar, for a like reason, is not calculated for the fluid ingredient. The best blue galls should alone be employed in making ink. Sumach, logwood, and oak bark, are frequently substituted for galls in the preparation of common ink. When such is the case, only about one-sixth or one-seventh of their weight of copperas should be employed.

2462. To Prevent Ink from Moulding. The addition of a few bruised cloves, or a little oil of cloves, or, still better, a few drops of creosote, will effectually prevent any tendency to mouldiness in ink.

2463. Fine Black Ink. Aleppo galls (well bruised), 4 ounces; clean *soft* water, 1 quart; macerate in a clean corked bottle for 10 days, or even longer, with frequent agitation; then add 1¼ ounces gum-arabic (dissolved in a wine-glassful of water); lump sugar ½ ounce; mix well, and afterwards further add 1½ ounces sulphate of iron (green copperas) crushed small, agitate occasionally for 2 or 3 days, when the ink may be decanted for use; but it is better if left to digest together for 2 or 3 weeks. When time is an object, the whole of the ingredients may be at once put into a bottle, and the latter agitated daily, until the ink is made; and boiling water instead of cold water may be employed. The above will make 1 quart of beautiful ink, writing pale at first, but soon turning intensely black.

2464. Cooley's Superior Black Ink. Bruised Aleppo nut-galls, 12 pounds; water, 6 gallons; boil in a copper vessel for 1 hour, adding water to make up for the portion lost by evaporation; strain and again boil the galls with water, 4 gallons, for ½ hour, strain off the liquor and boil a third time with water, 2½ gallons, and strain; mix the several liquors, and while still hot add green copperas (sulphate of iron) coarsely powdered, 4 pounds; gum-arabic bruised small, 3½ pounds; agitate until dissolved, and, when settled, strain through a hair sieve, and keep it in a bunged-up cask for use. This will produce 12 gallons, very fine and durable.

This ink, and that in No. 2463, are good. Cooley recommends them very highly. He says that they are very durable and limpid, and will bear dilution with nearly an equal bulk of water, and still be superior in quality to ordinary inks. Of the latter ink he says that he has writing that was executed with this kind of ink upwards of 60 years ago, which still possesses a good color.

2465. Black Ink. Campeachy logwood chips, 3 pounds; bruised galls, 9 pounds; boil in water, and to the mixed liquors add gum-arabic and green copperas, of each 4 pounds; to produce 16½ gallons of ink. Quality very good, but inferior to the above.

2466. Asiatic Black Ink. Logwood shavings and powdered galls, of each 2 pounds; green vitriol, 1 pound; gum, ½ pound; pomegranate bark, ¼ pound; water, 1 gallon; infuse 14 days with frequent agitation, or boil as directed in last receipt. This ink writes pale, but flows well from the pen, and soon turns black.

2467. Good Black Ink. Bruised galls, 2 pounds; logwood, green copperas, and gum, of each 1 pound; water, 6 gallons; boil the whole of the ingredients in the water for 1½ hours, and strain 5 gallons. Good, but not fine.

2468. Common Black Ink. Bruised galls, 1 pound; logwood, 2 pounds; common gum, ¾ pound; green copperas, ½ pound; water, 5 gallons; boil. Common, but fit for ordinary purposes.

2469. Exchequer Ink. Bruised galls, 40 pounds; gum, 10 pounds; green sulphate of iron, 9 pounds; soft water, 45 gallons; macerate for 3 weeks, employing frequent agitation. This ink will endure for centuries.

2470. Black Steel Pen Ink. A black ink, not corroding steel pens, and neutral, may be prepared by digesting in an open vessel, 42 ounces coarsely-powdered nut-galls, 15 ounces gum senegal, 18 ounces sulphate of iron (free from copper), 3 drachms aqua ammonia, 24 ounces alcohol, and 18 quarts distilled or rain water. Continue the digestion until the fluid has assumed a deep black color.

2471. Glycerine Ink. Take copperas, 4 ounces; nut-galls, 12 ounces; logwood, 8 ounces; vinegar, 8 ounces; gum-arabic, 1 ounce; glycerine, ½ ounce; water, 48 ounces; all the solid substances are to be pulverized and boiled for an hour together; they are then set to cool, strained through a flannel bag, and after that filtered through a folded filter. A drop of oil of cloves is added, the whole well shaken and filled into bottles. This ink will copy well.

2472. Dr. Ure's Ink. For 12 gallons of ink take 12 pounds bruised galls, 5 pounds gum, 5 pounds green sulphate of iron, and 12 gallons rain water. Boil the galls with 9 gallons of the water for 3 hours, adding fresh water to supply that lost in vapor; let the decoction settle, and draw off the clear liquor. Add to it the gum previously dissolved in 1½ gallons of water; dissolve the green vitriol separately in 1½ gallons of water, and mix the whole.

2473. Japan Ink. Aleppo galls, ½ pound; logwood chips and copperas, each 4 ounces; gum-arabic, 3 ounces; sugar, 1 ounce; blue vitriol (sulphate of copper), and sugar candy, each ½ ounce. Boil the galls and logwood in 6 quarts water till reduced one-half; strain; add the other ingredients. Stir until dissolved. Clear and bottle. If it does not shine enough, add more gum; also a few cloves, to prevent mould.

2474. Ink Powder. For an ink powder take 1 pound nut-galls, 7 ounces copperas, and 7 ounces gum-arabic. Pulverize and mix. This amount of ink powder will make 1 gallon of good black ink. Two or three powdered cloves should be mixed with each pound of powder, to prevent moulding.

2475. Permanence of Ink. The great difficulty with all iron inks is the precipitation which will take place, after a longer or shorter time, and which manufacturers have tried to obviate by substituting other materials. All inks, however, the basis of which is not tannate and gallate of iron, are not black immediately, and consequently not so agreeable to the eye when using them. The alizarine or rather indigo inks have a greenish, the chromium inks a reddish hue, and are not better adapted to withstand chemical agents than iron inks are.

2476. To Keep Ink from Thickening. The only way to keep writing ink thin with which we are acquainted is to protect it from the atmosphere. The air not only evaporates it, but oxidizes it and renders it thick. Those ink-stands which have a tapering funnel in the mouth will preserve the ink in its normal state much longer than the ordinary kind, because less of the surface is exposed.

2477. Writing Fluids. The very general use of steel pens has caused a corresponding demand for easy flowing inks, many of which have been of late years introduced under the title of "writing fluids," or "steel pen ink." These are mostly prepared from galls in the preceding manner, but a less quantity of gum is employed. The blue writing fluids, which either maintain their color or turn black by exposure, are prepared from the ferrocyanide of potassium (prussiate of potassa), or from indigo.

2478. Beautiful Blue Writing Fluid. Dissolve basic or soluble Prussian blue in pure water. This is the most permanent and beautiful ink known. It is not affected by the addition of alcohol, but is immediately precipitated by saline matter. The precipitate, however, still possesses the property of dissolving in pure water.

2479. To Test Prussian Blue. Pure Prussian blue feels light in the hand; adheres to the tongue; has a lively dark blue color, and gives a smooth deep trace. It should not effervesce with acids, as when adulterated with chalk; nor become pasty with boiling water, as when adulterated with starch. Prussian blue, rendered inferior in its color by an admixture of free oxide of iron, may be improved by digestion in dilute sulphuric or muriatic acid, washing and drying. Its relative richness in the real ferroprussiate of iron may be estimated by the quantity of potash or soda which a given quantity of it requires to destroy its blue color.

2480. Blue Writing Fluid. Dissolve the soluble ferrocyanide of potassium and iron in pure water. Resembles No. 2478, but is precipitated from its solution by alcohol.

2481. Stephens' Patent Blue Ink. *Mr. Stephens' process.* Take Prussian blue, (either of commerce, or the pure chemical combination of sesquioxide of iron with ferrocyanide of potassium), put it into any earthen vessel, and pour upon it as much strong hydrochloric, nitric, or sulphuric acid as will cover it (if sulphuric acid is used it must be diluted with an equal bulk of water); after standing 48 hours or more, add plenty of water, stirring it thoroughly, to remove the salts of iron; let it stand till all color has subsided, then draw off the clear liquid with a syphon; add fresh water, and repeat the washing until ferrocyanide of potassium ceases to produce a blue precipitate, and the water drawn off ceases to redden blue litmus paper, then filter the product. This treatment extracts much of the iron from the Prussian blue, and takes away its liability to precipitate by long standing. Next add and carefully mix 1 part oxalic acid to every 6 parts of Prussian blue; then dilute, by degrees, with water sufficient to make the blue ink any desired tint. The influences of air and dampness have a tendency to destroy the color of manuscript written with black ink, while the same influences tend to deepen and increase the color of the Prussian blue ink. This ink is only affected by continued exposure to light, which makes it fade in some degree; but it completely recovers its original depth of color by being put in a dark place.

2482. Mohr's Blue Writing Fluid. Triturate to a perfectly smooth paste, 6 parts pure Prussian blue, and 1 part oxalic acid, with a little water; then dilute with sufficient soft water to make it fluid.

2483. Runge's Black Writing Fluid. This is a cheap and good ink, and resists ordinary destructive agents well. It is perfectly liquid, scarcely thickens by age, deposits no sediment, and does not corrode steel pens. Digest ¼ pound logwood in fine chips for 12 hours in 3 pints boiling water; then simmer down gently to 1 quart, carefully avoiding dust, grease, and smoke. When cold, decant the decoction, and dissolve in it by agitation 20 grains yellow chromate of potash; it will then be fit for use.

2484. Shellac Ink, or Coathupe's Writing Fluid. To 18 ounces water add 1 ounce powdered borax and 2 ounces bruised shellac, and boil them in a covered vessel, stirring them occasionally till dissolved. Filter, when cold, through coarse filtering paper; add 1 ounce mucilage; boil for a few minutes, adding sufficient finely-powdered indigo and lampblack to color it. Leave the mixture for 2 or 3 hours for the coarser particles to subside; pour it off from the dregs, and bottle it for use.

2485. Arnold's Writing Fluid. Arnold's writing fluid is a mixture of sulphate of indigo and ordinary ink. It flows freely from the pen and at last becomes very black. On account of the large quantity of acid it contains, it is very destructive to steel pens, and for this evil we know of no cure.

2486. Blue Fluid for Making Blue-Black Writing Ink. Prussian blue in fine powder, 1 ounce placed in a common phial, and concentrated hydrochloric acid, 2 ounces, poured over it. Effervescence ensues, and the mixture soon assumes the consistence of a thin paste. After 24 hours it may be diluted with 8 or 9 ounces of water, and preserved in a glass bottle. The intensity of this color may be lessened by water. It forms an excellent blue writing fluid.

2487. Fine Writing Fluid. Dissolve ceruleo-sulphate of potassa or ammonia (soluble indigo) in hot water, and when cold decant the clear. It is an intense blue, and dries nearly black; is perfectly incorrosive, and very permanent and easy flowing. It may be thickened with gum water, or diluted with pure rain water, as required.

2488. Reade's Patent Blue Writing Fluid. Prepare a solution of iodide of iron, from iodine, iron, and water; add to the solution half as much iodine as first used. Pour this solution into a semi-saturated solution of ferroprussiate of potash, containing nearly as much of the salt as the whole weight of iodine. Collect the precipitate, wash it, and finally dissolve it in water, to form the blue ink. The solution from which the precipitate is separated, evaporated to dryness, and the residue fused, re-dissolved, and crystallized, yields pure iodide of potassa.

2489. Indelible Writing Fluid. To good gall ink, add a strong solution of fine soluble Prussian blue in distilled water. This addition makes the ink which was previously proof against alkalies, equally proof against acids, and forms a writing fluid which cannot be erased from paper by any common method of fraudulent obliteration without the destruction of the paper. This ink writes greenish blue, but afterwards turns intensely black.

2490. Precautions in Making Writing Fluids. All the preceding receipts for writing fluids, under proper management, produce excellent products. Care must be taken in all cases that the *ingredients be pure*, and unless this precaution is attended to, success is doubtful. Either of the preceding blue fluids may be used as indelible ink to mark linen, and will be found very permanent, provided the part be first moistened with alum water and dried.

2491. Gold Ink. Gold ink is prepared in the following way: Genuine gold leaf is rubbed with honey on a plate of agate or ground glass by means of a flat pestle, until the whole presents a uniform mass, in which no distinct particles of gold can be recognized. (*See No.* 2517.) This mass is carefully removed into a vessel with water, which will dissolve the honey, and leave the gold in an extremely disintegrated state behind. The water has, according to the size of the vessel, to be removed twice or three times, when all the saccharine matter will have been washed away. The remaining gold is then mixed with a sufficient quantity of a solution of gum-arabic, shaken well, and is ready for use. (*See No.* 2518.) The writing is to be rubbed, after drying, with a flat piece of ivory, when it will present the lustre of pure gold.

2492. Silver Ink. Silver ink is prepared in the same way, from silver leaf, as the gold in last receipt.

2493. Gold Labels on Glass Bottles. The finely divided gold, prepared as in No. 2491, is distributed in a solution of gum damar in naphtha, and the writing is to be done with this fluid by means of a brush. If the solution should become too thick in course of time, a little naphtha is added and well shaken, when the gold paint will be ready for use again. The gum damar in drying will cover the written lines with a kind of varnish that will protect the gold from the action of acids or alkalies.

2494. Purple Ink, or King of Purples. Infuse 12 pounds campeachy logwood in 12 gallons water; provide a funnel at the bottom of which a sponge has been placed; pour the infusion through a strainer made of coarse flannel into the funnel, and thence on to 1 pound hydrate or acetate of copper (verdigris); then add immediately 14 pounds alum; and for each 17 gallons of the liquid, add 4 pounds gum-arabic or senegal; let these remain 3 or 4 days and a beautiful purple will be produced.

2495. Green Ink. Boil 2 parts acetate of copper and 1 part bitartrate of potassa in 8 parts water, until the solution is reduced to half the bulk; filter through a cloth, and, when cool, bottle.

2496. Green Ink. Dissolve 180 grains bichromate of potassa in 1 fluid ounce of water; add, while warm, ½ ounce spirit of wine; then decompose the mixture with concentrated sulphuric acid, until it assumes a brown color; evaporate this liquor until its quantity is reduced to one-half; dilute it with 2 ounces distilled water; filter it, add ½ ounce alcohol, followed by a few drops strong sulphuric acid; it is now allowed to rest, and after a time it assumes a beautiful green color. After the addition of a small quantity of gum-arabic, it is ready for use.

2497. Violet, Magenta, and Solferino Ink. Inks of these, and such other bright aniline colors may be made as follows: Mix 1 drachm of the proper aniline color with 1½ ounces alcohol (*see No.* 2578) in a glass or enameled iron vessel; let it stand for 3 hours. Then add 13 ounces distilled water, and subject the whole to a gentle heat until the alcohol has evaporated, that is, until no odor of alcohol is perceptible; then add 4 drachms gum-arabic dissolved in 3 ounces water. Mix and strain. As the aniline colors of commerce vary a great deal in quality, the amount of dilution must vary with the sample used, and the shade determined by trial.

2498. Heusler's Red Ink. Take 2 ounces best Brazil wood, ½ ounce pulverized alum, ½ ounce crystals of bitartrate of potassa, and 16 ounces distilled water; boil down to one half, and strain. Then dissolve in it ½ ounce gum-arabic, and add 1½ drachms cochineal dissolved in 1½ ounces alcohol of specific gravity .839.

2499. Brilliant Red Ink. Brazil wood, 2 ounces; muriate of tin, ½ drachm; gum-arabic, 1 drachm; boil down in 32 ounces water to one half, and strain.

2500. Good Red Ink. Ground Brazil wood, 8 ounces; vinegar, 10 pints; macerate for 4 or 5 days; boil in a tinned-copper vessel to one half, then add roche alum, 8 ounces; and gum, 3 ounces; dissolve.

2501. Buchner's Carmine Ink. Pure carmine, 12 grains; water of ammonia, 3 ounces; dissolve, then add powdered gum, 18 grains; ½ drachm of powdered drop lake may be substituted for the carmine where expense is an object. This makes a superb carmine ink.

2502. Fine Red Ink. Cochineal, in powder, 1 ounce; hot water, ½ pint; digest, and when quite cold, add spirit of hartshorn, ¼ pint; or liquor of ammonia, 1 ounce; dilute with 3 or 4 ounces of water; macerate for a few days longer, then decant the clear. The color of this is very fine.

2503. Redwood's Red Ink. Guarancine and liquor of ammonia, of each 1 ounce; distilled water (cold), 1 pint; triturate together in a mortar, filter, and dissolve in the solution gum-arabic ½ ounce. (*Cooley.*)

2504. To Restore Writing Effaced with Chlorine. Expose it to the vapor of sulphuret of ammonia, or dip it into a solution of the sulphuret. Or: Ferrocyanide of potassa, 5 parts; water, 85 parts. Dissolve, and immerse the paper in the fluid, then slightly acidulate the solution with sulphuric or hydrochloric acid. The method found to answer best has been to spread the ferrocyanide thin with a feather or a bit of stick cut to a blunt point. Though the ferrocyanide should occasion no sensible change of color, yet the moment the acid comes upon it, every trace of a letter turns at once to a fine blue, which soon acquires its full intensity, and is beyond comparison stronger than the color of the original trace. If, then, the corner of a bit of blotting paper be carefully and dexterously applied near the letters, so as to imbibe the superfluous liquor, the staining of the parchment may be in a great measure avoided; for it is this superfluous liquor which, absorbing part of the coloring matters from the letters, becomes a dye to whatever it touches. Care must be taken not to bring the blotting-paper in contact with the letters, because the coloring matter is soft whilst wet, and may easily be rubbed off. The acid chiefly employed is the muriatic; but both the sulphuric and nitric succeed very well. They should be so far diluted as not to be liable to corrode the parchment, after which the degree of strength does not seem to be a matter of much nicety.

2505. To make New Writing Look Old. Take 1 drachm saffron, and infuse it into ½ pint ink, and warm it over a gentle fire, and it will cause whatever is written with it to turn yellow, and appear as if of many years' standing.

2506. To Write on Greasy Paper or Parchment. Put to a bullock's gall 1 handful of salt, and ¼ pint vinegar, stir it until it is mixed well; when the paper or parchment is greasy, put 1 drop of the gall into the ink, and the difficulty will be instantly obviated.

2507. To Remove Ink Blotches from Writing. When ink blotches have been formed over writing which it is desired to decipher, we are advised to brush off the spot carefully with a weak solution of oxalic acid by means of a camel's-hair pencil. In this way layer after layer of the superincumbent ink will be removed, and finally the writing itself will, in most cases, come to view. This is especially possible where some considerable interval has elapsed between the two applications of ink. As soon as the letters are visible the brushing should be continued for a time with clean water, so as to arrest the tendency of the acid solution to make a further change in the ink.

2508. Redwood's Indelible Marking Ink. Dissolve 1 ounce nitrate of silver and 1½ ounces crystallized carbonate of soda in separate portions of distilled water, and mix the solutions; collect the resulting precipitate on a filter, wash it thoroughly with distilled water, and introduce it, while still moist, into a wedgwood-ware mortar; add 8 scruples tartaric acid, and triturate the whole until effervescence has ceased; next add sufficient ammonia to dissolve the tartrate of silver; mix in 4 fluid drachms archil, 4 drachms white sugar, and 12 drachms finely-powdered gum-arabic; then add sufficient distilled water to make 6 ounces of the mixture. This ink fulfills all the conditions that a marking ink should possess: It flows freely from the pen without running or blotting; it does not require a very strong or long continued heat to develop it; when developed it is perfectly black; and it does not injure the texture of the finest fabric.

2509. Indelible Ink. The linen is first moistened with a fluid consisting of a mixture of 2 parts carbonate of soda in crystals, 2 parts gum-arabic, 8 parts water, and then dried. When quite dry, it is rubbed with a glass or smooth pebble to render it as smooth as possible, so that it may be easier to write upon. The composition of the ink itself is as follows: 1⅔ parts nitrate of silver, 16 parts distilled water, 2 parts gum-arabic, and ⅛ part sap green. The nitrate of silver is first dissolved in the distilled water, and the gum-arabic and sap green are subsquently added. It is necessary to write with a quill pen, all metallic pens except gold ones decomposing the ink. It is a good plan to trace the letters on the linen with a pencil before writing them. This and the four following receipts are by Dr. Reiman, who says that they have all been thoroughly well tried, and found effectual.

2510. Fine Marking Ink. Marking linen is most conveniently effected by using a small stiff brush and a small copper plate with perforations corresponding to the letters required. This stencil plate is laid upon the linen, and the ink is rubbed into the cut-out spaces with the brush. The following ink is of service for marking linen with a stencil plate: 2 parts nitrate of silver, 4 parts distilled water, 2½ parts gum-arabic, 3 parts carbonate of soda crystals, 5 parts liquid ammonia. The best way to prepare the ink is to first dissolve the nitrate of silver in the liquid ammonia, and the gum-arabic and soda in the distilled water. The two solutions are then mixed together and slightly warmed, when the whole mixture becomes brown. A few drops of a solution of magenta makes the ink somewhat more distinct. When this method is used, the linen requires no previous preparation.

2511. Aniline Marking Ink. Dissolve 8½ grains bichloride of copper in 30 grains distilled water, then add 10 grains common salt, and 9½ grains liquid ammonia. A solution of 30 grains hydrochlorate of aniline in 20 grains distilled water is then added to 20 grains of a solution of gum-arabic (containing 2 parts water, 1 part gum-arabic), and lastly 10 grains of glycerine. 4 parts of the aniline solution thus prepared are mixed with 1 part of the copper solution. The liquid which results has a green appearance, and may be at once employed for marking linen, since it invariably becomes black after a few days. A steel pen may be employed as well as a quill. If it is desirable not to wait so long for the appearance of the black color, a hot iron may be passed over the writing when the ink is dry, or the linen may be held over the flame of a spirit lamp, or over a hot plate, or hot water, when the black tint will readily appear. It is a good plan to put the linen, when marked, into a tepid solution of soap, which has the effect of bringing out a fine bluish tint. The ink must be so limpid that it is able to permeate the tissue of the linen, so that the marks appear on both sides. It is advisable to mix the solutions together, only when the ink has to be used. It is perfectly indelible, and so easy to write with that the finest devices may be drawn with it. This ink has the advantage of being cheaper than the ink prepared from nitrate of silver. It has also another advantage over the latter salt, viz.: that it is chemically indelible.

2512. Purple Marking Ink. A purple marking ink can be prepared by mixing 1 part bichloride of platinum with 16 parts distilled water. The place where the letters have to be written must be moistened with a solution of 3 parts carbonate of soda, 3 parts gum-arabic, and 12 parts water. The spot is then dried and made smooth. After the letters have been written with the platinum ink and become dry, the linen is moistened with a solution of 1 part chloride of tin in 4 parts distilled water, when an intense and beautiful purple-red color makes its appearance.

2513. Cheap Brown Marking Ink. A very cheap brown marking ink may be prepared from 4 parts acetate of manganese dissolved in 12 parts water. The place on the linen where the marks have to be made must be previously moistened with the following solution: 1 part yellow prussiate of potash, ½ part gum-arabic, 3 parts water. The linen, having been saturated with the above solution, is dried, and afterwards marked with the manganese solution. On the letters becoming dry, the following solution is spread over the spot with a brush: 4 parts carbonate of potash, 10 parts water. The letters then become brown, and their color cannot be removed by alkalies, nor by acids, with the exception of dilute hydrochloric acid.

2514. Carbon Ink. Genuine Indian ink rubbed down with good black ink until it will flow easily from a pen. This ink resists chlorine, and oxalic acid.

2515. Indian or Chinese Ink. The pure article can only be obtained from China. A good imitation may be made with ivory black, ground to an impalpable powder, made into a paste with weak gum-arabic water, perfumed with a few drops of essence of musk and half as much essence of ambergris, and then formed into cakes. (*See No.* 2716.)

2516. Perpetual Ink for Tombstones, &c. Equal parts of Trinidad asphaltum and oil of turpentine. Use in a melted state to fill in the letters and devices on tombstones, &c. Without actual violence it will last as long as the stone.

2517. To Pulverize Gold and Silver Leaf. This is effected by grinding upon a porphyry slab, with a muller, gold or silver leaves with white honey, until they are reduced to the finest possible state of division. Then wash the honey thoroughly from the powdered metal and mix with gum water. (*See also No.* 25.)

2518. Liquid Gold, for Vellum, &c. Take gold leaf and grind it with gum water; then add a small quantity of bichloride of mercury, and bottle for use.

2519. Liquid Silver, for Vellum, &c. Take silver leaf and grind it with gum-water or glaire of egg.

2520. Copying Ink. The virtue of copying ink consists in its non-drying property. This property may be given to any ordinary ink by the addition of sugar. Lately, however, glycerine has been substituted for sugar, and is decidedly to be preferred. A good copying ink may be made from common violet writing ink, by the addition of 6 parts glycerine to 8 parts of the ink. Using only 5 parts glycerine to 8 of the ink, it will copy well in fifteen minutes after it has been used. With fine white copying paper the ink will copy well without the use of a press.

2521. Ink for Marking Packages. Take lampblack and mix thoroughly with sufficient turpentine to make it thin enough to flow from the brush. Powdered ultramarine, instead of lampblack, makes a fine blue marking mixture for the same purpose.

2522. Ink for Marking Packages. An excellent and very cheap ink is made by mixing ½ ounce bichloride of potassa and 4 ounces extract of logwood in a stone jar or demijohn, with 2 gallons of hot water. Shake well and let it stand for about 2 weeks, shaking occasionally.

2523. Permanent Ink for Writing in Relief on Zinc. Bichloride of platinum, dry, 1 part; gum-arabic, 1 part; distilled water, 10 parts. The letters traced upon zinc with this solution turn black immediately. The black characters resist the action of weak acids, of rain, or of the elements in general, and the liquid is thus adapted for marking signs, labels, or tags which are liable to exposure. To bring out the letters in relief, immerse the zinc tag in a weak acid for a few moments. The writing is not attacked while the metal is dissolved away.

2524. Ink for Zinc Labels. Take 1 drachm of verdigris, 1 drachm sal ammoniac powder, and ½ drachm lampblack, and mix them with 10 drachms water; and this will form an indelible ink for writing on zinc.

2525. To Write on Silver with a Black that will Never Go Off. Take burnt lead and pulverize it. Incorporate it next with sulphur and vinegar, to the consistency of a paint, and write with it on any silver plate. Let it dry, then present it to the fire so as to heat the work a little, and it is completed.

2526. Indestructible Inks. Employed for writing the labels on bottles containing strong acids and alkaline solutions. They are capable of resisting the action of iodine, chlorine, alkaline lyes and acids, as well as operations of dyeing and bleaching, besides being an excellent and cheap material for marking linen, as nothing will remove them without destroying the fabric.

2527. Hausmann's Indestructible Ink. Mix 1 part genuine Trinidad asphaltum with 4 parts oil of turpentine; color with a sufficiency of plumbago, for black, or vermilion for red ink.

2528. Close's Indestructible Ink. Mix 25 grains powdered cobalt and 200 grains oil of lavender by a gentle heat; color with 3 grains lampblack and 1 grain indigo, both in fine powder. If a red color is required, omit the lampblack and indigo and add sufficient vermilion to make the mixture a good color.

2529. Indestructible Writing Ink. Shellac, 4 parts; borax, 2 parts; soft water, 36 parts; boil in a close vessel till dissolved; then filter, and take of gum-arabic, 2 parts; soft water, 4 parts. Dissolve, and mix the two solutions together, and boil for 5 minutes as before, occasionally stirring to promote their union; when cold, add a sufficient quantity of finely powdered indigo and lampblack to color; lastly, let it stand for 2 or 3 hours, until the coarser powder has subsided, and bottle for use. Use this fluid with a clean pen, and keep it in glass or earthen inkstands, as many substances will decompose it while in the liquid state. When dry it will resist the action of water, oil, turpentine, alcohol, diluted sulphuric acid, diluted hydrochloric acid, oxalic acid, chlorine, and the caustic alkalies and alkaline earths.

2530. Simple Carbon Ink. Dissolve 30 grains of sugar in 30 grains of water, to which add a few drops of concentrated sulphuric acid. Upon heating this mixture the sugar becomes carbonized by the acid, and when applied to the paper it leaves a coating of carbon which cannot be washed off. This stain is rendered more perfect by the decomposing action of the ink itself upon the paper, and thus resists the action of chemical agents.

2531. Drawing Ink. A very black and indelible drawing ink may be made by dissolving shellac in a hot water solution of borax, and rubbing up in this solution a fine quality of Indian ink. After using, dip the drawing pen in alcohol, and wipe dry to keep it clean and bright. (*See No.* 2514.)

2532. Permanent Ink for Use with Stamps or Type. Mix equal parts black oxide of manganese and hydrate of potash, heat to redness, and rub with an equal quantity of smooth white clay into a paste, water being added for the purpose. Or: Sulphate of manganese, 2 drachms; lampblack, 1 drachm; powdered loaf sugar, 4 drachms; rubbed into paste with water. After stamping, dry the linen and wash well in water.

2533. Sympathetic, or Invisible Inks, for Secret Writing. These are colorless inks which require the aid of heat or some other agency to develop the characters written with them. Their use has been rendered specially practical since the recent introduction of the postal correspondence cards in England and elsewhere. By previous arrangement between correspondents, the receiver of a card only needs some *visible* sign on the card to identify the writer or sender; this will at once suggest the means to be employed to develop the particular ink the receiver's correspondent has agreed to use.

2534. Black Sympathetic Inks. Writing with a solution of sugar of lead will be turned black by moistening the paper with sulphide of potassium.

If nitrate of silver be used, the writing will become black by dipping the paper in a solution of ammonia.

Chloride of mercury will turn black when wetted with chloride of tin.

A weak infusion of galls is turned black by sulphate of iron (copperas).

Reversing the above, writing with copperas turns black by moistening with infusion of galls.

2535. Blue Sympathetic Inks. Writing with copperas turns blue if wetted with a solution of prussiate of potassa.

Nitrate of cobalt turns blue on being wetted with a weak solution of oxalic acid.

Rice water or a solution of boiled starch turns blue in a solution of iodine in weak spirit.

2536. Brown Sympathetic Ink. A diluted solution of nitrate of silver turns brown by exposure to the sunlight.

2537. Yellow Sympathetic Ink. Chloride of antimony, used as the ink, will become yellow by moistening with a decoction of galls.

2538. Green Sympathetic Ink. Arseniate of copper, washed over with nitrate of copper, turns a beautiful green.

2539. Purple Sympathetic Ink. Purple is produced by using chloride of gold, and soaking in chloride of tin.

2540. Sympathetic Inks Developed by Heat. There are a number of colorless substances that may be used as inks, which are developed by the application of heat only.

Sulphate of copper and sal ammoniac, mixed in equal parts, will become yellow if exposed to the fire.

Onion juice has the same property as the above mixture.

Lemon juice, a very weak solution of either aquafortis, oil of vitriol, common salt, or saltpetre, will turn yellow or brown on exposure to the fire.

A weak solution of chloride of cobalt and chloride of nickel is turned a beautiful green by heat.

A solution of chloride or nitro-muriate of cobalt, turns green when heated, and disappears again on cooling.

A dilute solution of chloride of copper becomes a fine yellow at a moderate heat, and disappears on cooling.

A solution of acetate of cobalt, with a little nitrate added to it, turns rose-colored by heat, and disappears again when cold.

These last, which disappear again on cooling, are the best sympathetic inks for purposes of correspondence, as the others are more or less indelible when once developed.

2541. Hoe's Composition for Printing Ink Rollers. This consists of glue and molasses, the proportions varying from 8 pounds of glue in summer to 4 pounds in winter, for each gallon of molasses. The glue should be placed for ½ an hour in a bucket, covered with water, then pour the water off and allow the glue to soften. Put it into a kettle and heat it until thoroughly melted; if too thick, a little water may be added. Lastly, the molasses is stirred in and well mixed with the glue. When properly prepared, an hour's boiling will be sufficient, as too much boiling is apt to candy the molasses. Pour into a clean mould well oiled with a swab.

2542. To Clean Ink Rollers. Rollers should not be washed immediately after use, as they will become dry and skinny, but they may be washed ½ hour before using again. In cleaning a new roller, a little oil rubbed over it will loosen the ink, and it should be scraped clean with the back of a knife; it should be cleaned this way for about a week, when lye may be used. New rollers are often spoiled by washing too soon with lye.

2543. Black Printing Ink. Boil 1½ gallons old clear linseed oil to the consistence of a thick varnish; whilst hot, add to it, during constant stirring, first 6 pounds powdered resin, and next 1¾ pounds dry brown soap shavings; then mix in it 2½ ounces indigo blue, 2½ ounces Paris blue, and 5 pounds best lampblack. After standing for a week it should be ground.

2544. Black or Colored Printing Ink. Balsam copaiba, 9 ounces; lampblack, 3 ounces; Paris blue, 1¼ ounces; Indian red, ¾ ounce; dry resin soap, 3 ounces. These will produce a superior black ink. By employing white soap instead of yellow, and a sufficiency of some coloring pigment instead of the black, blue, and red mixture, a good colored ink will be obtained.

2545. New Ink for Printers. A new ink for printers has been invented by Professor Artus, and Mr. Fleckstein, a master-printer at Lichtenhain, which ink is said to be a complete success. The composition of it is as follows: Venetian turpentine, 4½ ounces; fluid soap, 5 ounces; rectified oleine, 2 ounces; burnt soot, 3 ounces; Paris blue (ferrocyanic acid), ½ ounce; oxalic acid, ¼ ounce; distilled water, ½ ounce. The mixing process of this new, beautiful, and cheap ink is described as follows: Gradually warm the turpentine and the oleine together; put the soap on a marble plate, and gradually add, continually rubbing, the mixture of turpentine and oleine; when well mixed, add the burnt soot, which must first be well powdered and sifted; then add the Paris blue, dissolved in the oxalic acid, continually rubbing the composition on the stone, the Paris blue and the oxalic acid having been mixed before with water in the above given proportions. A solution of soda in water is sufficient to thoroughly cleanse the type.

2546. Indelible Printing Ink. Mix 1 pound varnish (such as is used for ordinary printing ink), 1 pound black sulphuret of mercury, 1 ounce nitrate of silver, 1 ounce sulphate of iron, 2 table-spoonfuls lampblack. Thoroughly grind together, adding enough turpentine to reduce to the requisite consistency.

2547. Lithographic Ink. Grind together 8 parts mastich, in tears, and 12 parts shellac; dissolve carefully by heat in 1 part Venice turpentine; after the mixture is taken from the fire, mix in 16 parts wax and 6 parts tallow; then add, by stirring, 6 parts hard tallow soap in shavings, and finally incorporate in the mass 4 parts lampblack. Heat and stir until thoroughly mixed; let it cool a little, and pour it out on tables, and when cold, cut into square rods.

2548. Lithographic Transfer Ink. Melt together 8 parts white wax and 2 parts white soap; and, before they become hot enough to take fire, stir in by degrees sufficient lampblack to make the mixture black; then allow the whole to burn for 30 seconds; when the flame is extinguished, add, a little at a time, 2 parts shellac, stirring it in constantly; put the vessel on the fire again until the mass is kindled, or nearly so. Put out the flame and allow it to cool a little, and then run it into the moulds. Ink thus made will make as fine or coarse lines as are desired, and its traces will remain unchanged for years before being transferred. When suet enters into the composition of lithographic crayons, it does not keep long, and requires immediate transferring to the stone.

2549. Lithographic Ink. M. Lasteyrie states that, after having tried a great many combinations, he gives the preference to the following:—Dry tallow soap, mastich in tears, and common soda in fine powder, of each 30 parts; shellac, 150 parts; lampblack, 12 parts; mix as last. Used for writing on lithographic stones.

2550. To Test the Quality of Lithographic Ink. Lithographic ink of good quality ought to be susceptible of forming an emulsion so attenuated that it may appear to be dissolved when rubbed upon a hard body in distilled or river water. It should be flowing in the pen, not spreading on the stone; capable of forming delicate traces, and very black, to show its delineations. The most essential quality of the ink is to sink well into the stone, so as to reproduce the most delicate outlines of the drawing, and to afford a great many impressions. It must, therefore, be able to resist the acid with which the stone is moistened in the preparation, without letting any of its greasy matter escape.

2551. Durable Autographic Ink. White wax, 8 ounces; and white soap, 2 to 3 ounces; melt; when well combined add lampblack, 1 ounce; mix well, and heat it strongly; then add shellac, 2 ounces; again heat it strongly; stir well together, cool a little, and pour it out. With this ink lines may be drawn of the finest to the fullest class without danger of its spreading, and the copy may be kept for years before being transferred. This ink is employed for writing on lithographic paper, and is prepared for use by rubbing down with a little water in a saucer, in the same way as common water-color cakes or Indian ink. In winter this should be done near a fire, or the saucer should be placed over a basin containing a little warm water. It may then be used with either a steel pen or a camel's-hair pencil.

Aniline Colors.

Aniline is a liquid of a color varying from yellow to dark brown. The commercial article is never chemically pure, being a mixture of pure aniline, toluidine, and odorine. Its boiling point ranges from 356° to 482° Fahr. If aniline boils at a lower temperature than 356°, it contains too much odorine, and is, therefore, of poor quality. It is obtained by conversion from nitro-benzole, a preparation of the benzole obtained from *coal tar* (not from petroleum). In preparing nitro-benzole on a large scale, 12 parts benzole are mixed with 13 parts fuming nitric acid, and 8 parts oil of vitriol, in a cast iron apparatus. The character of the product depends greatly on the purity of the benzole, and also on the management of the reaction. The conversion of nitro-benzole into aniline is, by Béchamps' process, performed in iron tanks, heated by steam, and provided with stirrers, and a still-head to collect the distillates. The tank or still is charged with 100 parts nitro-benzole, 150 clean wrought iron filings, 100 water, and 150 acetic acid; when these are mixed spontaneous heat is evolved, which causes some of the liquid to pass into the condensers, whence it is returned to the tank. As the heat is not sufficient for the complete conversion of the nitro-benzole, steam is introduced after a time, and the stirring and steaming is continued until no more nitro-benzole appears in the distilled vapor. At this point the temperature is increased, and, if necessary, aided by direct fire, to cause complete distillation of the aniline which has formed, and which passes off with water, and separates from it on standing, as the heavier stratum. The aniline used for the various colors is taken of different composition and boiling-point. A. W. Hofmann has shown that a mixture of an equivalent of aniline and two of toluidine produces the largest yield of rosaniline (fuchsine). The substance used for this manufacture begins to boil at about 347°, and as the heat increases to 390° 80 per cent. will have distilled over. Aniline blue and purple require an oil which begins to boil at 374°, and at 392° has lost only 60 per cent. Evidently with these properties it contains less aniline than the preceding one. The changes which these bases undergo when converted into dyes or compounds of rosaniline, are brought about by the partial destruction of a portion of them.

2553. Rosaniline, or Fuchsine. The principal methods for the manufacture of fuchsine employ arsenic acid, the reaction being brought about in a cast iron still with movable head, connected with a condenser, and provided with a manhole, and also a place for a thermometer. This still sits in a jacket containing a hot bath of palm-oil, which keeps it at a temperature of from 320° to 356° Fahr. A charge consists of 100 parts aniline and 200 parts arsenic acid, and the reaction is ordinarily completed in about 6 hours, sometimes in 5, but at others only in 12 hours, during which time the temperature is carefully regulated. Assays are taken from time to time, and the completion of the process is known by the pure bronze color of the sample. The fused mass is transferred to a tank, in which, after cooling, it is broken up, and at once treated with water and steam. The base fuchsine (rosaniline) dissolves, leaving behind the resinous products of the reaction; the arsenic acid is separated by the addition of milk of lime. The filtered solution, after proper concentration, deposits, on cooling, fine crystals of fuchsine, as do also the first mother liquors. An inferior quality of fuchsine is obtained by adding a portion of salt, varying in quantity.

2554. Aniline Blue. Aniline blue results from various processes. The one most commonly used at present is that of Girard and De Laire, made by heating fuchsine with fluid aniline. The original process produced a blue with a reddish tinge; but by the addition of some organic substances, acetic acid, and methylic alcohol, pure blue is obtained. It is distinguished from all other blues by not appearing green in candle light. The various shades of purple to blue and violet are made from fuchsine by Hofmann's method (*see No.* 2608), heating 1 part fuchsine and 2 iodide of ethyl with 2 parts alcohol in a closed vessel at 212° for variable lengths of time; the blue resulting from longest exposure.

2555. Aniline Green. Aniline green is produced from a solution of sulphate of rosaniline in dilute sulphuric acid and some aldehyde, which is heated till its color has changed to dark green. Addition of a solution of hyposulphite of soda separates the color.

2556. Aniline Green. Several of the aniline greens occurring in the market are apt to undergo spontaneous destruction, sometimes in less than a day. The following is a formula which any one may make: 4 parts of pure fuchsine or rosaniline are dissolved in 6 parts water and 16 parts aldehyde (*see next receipt*), and are heated at 212° Fahr., until a drop of the mixture imparts to water acidulated slightly with sulphuric acid a clear blue color, when it is ready to be poured into a boiling solution of hyposulphite of soda, which is being stirred. A fine green precipitate forms, and a grayish one, which latter must be kept separate. The green is mordanted principally with acetate of alumina.

2557. To Prepare Aldehyde. Aldehyde is made by filling a tubulated glass retort, altogether to one-third full, with 32 parts absolute alcohol, 30 parts bichromate of potassa, and, without previous cooling, a mixture of 35 parts oil of vitriol, and 30 of water, in small portions, through a safety-tube in the tubus. After one-half of the latter has been introduced, the mixture commences to boil and aldehyde begins to distill over, the remainder of the said mixture being added through the tubulus as required. No further purification is needed.

2558. To Make Aniline Colors Soluble in Water. The aniline colors insoluble in water may, according to Dr. Zinsman, be rendered soluble in the following way:—A solution of gelatine in acetic acid of about the consistence of syrup is first made, and the aniline color in fine powder is gradually added, stirring all the time so as to obtain a homogeneous paste. The mixture is then to be heated over a water-bath to the temperature of boiling water, and kept at that heat for some time. Colors in this state, if a very clear gelatine is employed, will be applicable to many decorative purposes. Bookbinders, paper-stainers, and printers will find them useful. They may also, it is said, be used to color confectionery and soaps. Before they are used for confectionery, however, it will be well to make sure that no arsenic is present.

2559. Injurious Effects of Impure Alcohol upon Aniline Colors. Dr. Tillmanns has examined several varieties of alcohol, and tested the effects upon aniline colors. The most sensitive among these, for impure alcohol, is aniline purple (phenyl-rosaniline). It appears that empyreumatic substances, aldehyde, the peculiar fusel oils due to the substances used in the manufacture of the alcohol, affect the aniline colors when dissolved in such alcohols and boiled therewith. The best test for the purity of an alcohol is to dissolve in it 1 per cent. of perfectly pure caustic potassa, and to heat the solution; it should only acquire a bright yellow color. Another test is to dissolve 1 part of the aniline purple alluded to in 50 parts of the alcohol to be tested, and to heat the fluid for some time. If, after half an hour's heating, no change is observed, the quality of the alcohol is good; but if the latter is not pure enough, the mixture soon becomes turbid, and assumes a red color. Another test is to make two solutions of the color of the same strength (1 in 50), one with alcohol of known purity, and the other with the suspected alcohol, and then compare the intensity and shade of the solutions. Aldehyde is often present in alcohol, especially if it has been purified by means of charcoal.

2560. To Test the Quality of Aniline Colors. A good and practical way of testing the merits of aniline colors is to have, and keep on hand, a standard and measure of comparison, a sample whose value and coloring power has been ascertained by actual practice. If a new supply of dye stuff is to be tested, weigh out equal quantities of the standard coloring matter and of the one to be tested (say 10 to 30 grains); dissolve them, using the same quantity of alcohol and water, in vessels of as nearly as possible equal size; introduce in each an equal quantity of white wool; place them on a water bath; raise the temperature gradually, and after sufficient time has elapsed, take the two pieces out, dry them carefully, and compare them. That which has been dyed with the best dye, will, of course, show the fullest, brightest, and clearest color. Instead of testing on skeins of wool, Mr. Shuttleworth recommends small squares of white merino or cashmere, as affording a more even surface, and a greater mass of color. A known weight of the dye should be dissolved in alcohol and added to the bath of warm water, with the necessary mordants. A square of cloth of known weight —say 10 grains—is immersed in the bath, and, after a stated time, removed. The strength and shade of the color can thus be compared with previous samples, dyed under like conditions. It is a good plan to paste these squares, by one edge, in a blank book, noting anything worthy of remark on the margin. The colors are thus preserved from the action of the light, and will be found very useful for reference.

2561. Test for Sugar in Aniline Dyes. Aniline blue and aniline green have been found adulterated with a considerable quantity of sugar. Mr. Joly, of Brussels, has also found this to be the case with red aniline colors, such as fuchsine, rubine, &c., the adulteration amounting in some cases to as much as 50 per cent. The amount of sugar present can be ascertained by treating a sample of the suspected dye with absolute alcohol; or, still better, with a mixture of alcohol and ether; the sugar will remain undissolved.

2562. To Remove Sugar from Aniline Dyes. If it be found by the test given in No. 2561, that an aniline color has been adulterated with sugar, this may be removed by repeatedly washing the color with cold water, which will dissolve the sugar.

2563. General Directions for the Use of Aniline Dyes. It is impossible to use any dye, successfully, without due regard to cleanliness. This is, perhaps, more particularly the case with the anilines. The slightest trace of a foreign substance will often materially alter the shade. Earthen or enameled vessels should be used whenever practicable. Iron is generally to be avoided, if for no other reason than that it is difficult to say when it is really clean. Woolen and silken goods, before being dyed, should be thoroughly washed in soap and water, and then carefully rinsed in clean rain water. Cotton requires a previous mordanting before it can be dyed with anilines, as vegetable fibre possesses no affinity for the colors. The preparation generally consists in treatment by sumac, or stannate of soda, and subsequently by sulphuric acid; special directions will be given in those cases requiring particular treatment. Old fabrics which were dyed before, may be freed from color by previous boiling for an hour in strong soapsuds. The spirit used should be pure, and especially free from aldehyde; methyl spirit does not appear to injure some of the dyes. Spirit containing shellac turns roseine of a bluish color.

2564. To Distinguish Aniline from Other Dyes. Aniline colors, for dyeing purposes, are now used to such an extent throughout the country as almost to exclude all others, on account of their brilliancy and cheapness. They are, however, liable to lose in appearance by bright sunlight, and in lustre by the artificial light of gas or candles. It is, therefore, desirable to have a ready means by which they can be recognized. This is all the more necessary, as arsenic acid is generally employed in their preparation; and a cloth that has been dyed with an aniline color containing it may have absorbed a considerable quantity of that dangerous article. The readiest way for its detection is to boil the flannel, or whatever other cloth it may be, with a solution of caustic soda or potassa, and, after filtering the fluid from the residue, neutralizing it with hydrochloric acid. If the cloth has been dyed with an aniline color, the fluid will show a coloration. Most of the aniline dyes may also be extracted by boiling alcohol, which process, perhaps, can be performed in less time than the other.

2565. To Remove Aniline Colors. There are various ways proposed to remove aniline colors, the following being the simplest and most practical. Goods dyed with aniline colors may easily be rendered white by the use of zinc gray; the metallic zinc contained in this powder reduces the colors, forming soluble colorless products. To apply the principle, triturate 100 grains zinc gray with 50 grains mucilage marking 20° Baumé, until the mixture is homogeneous; incorporate with this 20 grains of a solution of hyposulphite of soda marking 20° Baumé, apply this mixture directly to the goods, let it dry and vaporize. After this operation it is best to wash the goods with water slightly acidulated with hydrochloric acid. Cotton goods may be bleached by chlorine or bleaching liquor, but this is not applicable to other than cotton fabrics.

Another simple method consists in digesting the fabrics for a sufficient length of time in 90 per cent. alcohol, which usually completes the decolorization in a short space of time. The same alcohol can be used several times in succession, and can afterward be purified by rectification or redistillation, so as to involve but little loss. The work is best done in a well-covered copper kettle, which is to be set in boiling water. A little hydrochloric acid may be added if the articles are not too delicate, thereby increasing the solubility of the aniline colors.

If all other methods fail, cyanide of potassium is absolutely certain. A stone vessel is to be selected, in which a small quantity of cyanide of potassium is to be introduced, and hot water poured upon it, so as to make a solution of ½° to 1° Baumé. The whole is to be stirred well with a long and strong glass rod, and the operation conducted in the open air, so that no harm may result from the condensation of the vapor. The fabric in question, previously well cleaned, is now placed in the vessel, and pushed under the liquid with the glass rod, and the top of the vessel laid on. It is advisable to keep the solution warm, by immersing the stone vessel in a wooden tub properly supplied with steam or hot water. After a short time the lid should be removed by taking it off at the end of a long handle, allowing the vapors to pass off before the operator comes near. By means of the glass rod the cloth is to be lifted, and if not entirely white, is to be replaced and the process continued still longer. When finished the cloth is to be transferred by means of the glass rod to a large vessel containing hot water, and stirred around for a time, then removed and rinsed off. The solution of the cyanide of potassium can be used several times without losing its power. Cyanide of potassium is a deadly poison; contact with any sore or cut is extremely dangerous, and inhaling its vapor is sudden death.

2566. To Remove Stains of Aniline from the Hands. The best way to remove such stains from the hands is to either wash them with strong alcohol, or what perhaps is more effectual, to wash them with a little bleaching powder, and finally with alcohol.

2567. Phosphate of Lime as a Mordant. A rather thick syrupy solution of phosphate of lime (bone-ash) in hydrochloric acid having been recently recommended as a mordant to be used after a previous sumaching of the goods, Dr. Reimann states that, according to his researches, the phosphate of lime solution is altogether superfluous for aniline dyes, since a sumaching with 4 pounds sumach to 20 pounds cotton is of itself a sufficient mordanting to fix aniline colors excellently. The application of the phosphate of lime solution as a mordant for cochineal colors upon cotton he also considers as quite useless.

2568. New Mordant Applicable to Aniline Colors. For this purpose the oxide of zinc, in accordance with a patent taken out in France by MM. Biot and Thisau, may be used for mordanting aniline blue upon cotton, or the iodine green upon wool. The mordanting is effected by simply immersing the goods for some hours in a bath of cold water, in which chloride or acetate of zinc has been dissolved until the solution shows 2° Baumé; for the wool the mordanting bath should be at a boiling heat, and the goods should also be placed in a warm bath of tannin 90° Fahr. for half an hour. In dyeing, a hot solution of the color must be used, to which should be added, in the case of the cotton, some chloride of zinc, and, in the case of the wool, a certain amount of tannin solution.

2569. To Dye Aniline Opal Blue on Cotton. To mordant the aniline color known as opal blue upon cotton it is recommended to rinse the goods, after bleaching, in a dilute solution of soda crystals, to neutralize the acid of bleaching, then to pass them into a hot bath of soap, in which oil exists in emulsion in these proportions: Water, 100 liters (211 pints).; soap, 8 kilos (21½ pounds troy); oil, 2 kilos (5⅓ pounds troy). Wring them out, dry, and pass them into a solution of acetate of alumina of about 4° or 5° Baumé, wring out, dry, and rinse in hot water. Finally dye in a solution of opal blue to which acetic acid has been added. The temperature of the dye bath should be 75° to 90° Fahr. Rinse and dry.

2570. Difficulty in Dyeing Cotton with Aniline. This difficulty consists in the irregularity of intensity of color when the aniline colors are applied. This effect is attributed to the unequal oxidation of the tin salts applied before dipping the goods into the dye bath; in using these colors, avoid the use of the tin salts, which have little or no beneficial effect on the results in any case; and dip the goods into the dye bath, after treating with infusion of nut-galls or sumach. If tin must be used, the best salt of that metal is the bichloride.

2571. Aniline Black. When a salt of aniline in solution is exposed to the action of certain oxydizers, as salts of copper, chlorate, and bichromate of potassa, it yields a black dye, of such depth that ordinary gall or madder blacks appear gray or green in comparison. The fastness of this color, its resistance to the action of acids, alkalies, soaps, and sunlight, render it of great importance to manufacturers, and make it one of the great achievements of late years.

2572. Aniline Black for Dyeing. According to Mr. Köchlin, aniline black is produced as follows: Water, 20 to 30 parts; chlorate of potassa, 1 part; sal ammoniac, 1 part; chloride of copper, 1 part; aniline, hydrochloric acid, of each 1 part, previously mixed together. Several other formulæ for producing aniline blacks have been devised for dyeing purposes. It is essential in each of them, and always, that the preparation shall be acid, and the more acid it is, the more rapid is the production of the blacks. The action, of course, if it be excessive, will be likely to injure the fibre of the fabric.

2573. Aniline Black on Wool. For 2 pounds of wool a bath is prepared of 20 quarts water, 3 ounces permanganate of potassa, 4¼ ounces sulphate of magnesia. The use of sulphate of magnesia has for its object, to prevent the formation of caustic alkali, and has already been proposed by Tessié du Mothay. The wool is impregnated with this solution, and left in it until the fluid has become colorless, or nearly so, whereby it is colored dark-brown and covered with brown oxide of manganese. This process takes place easily in the cold, but it is best to dissolve the permanganate in hot water. The wool is now pressed out, and, without washing, conveyed into a bath of 12 ounces commercial aniline oil, 21 ounces commercial hydrochloric acid, and 8 quarts water, where it is moved about in the cold; it attains here directly a dark green-black color. It is pressed out again, washed in water containing a little soda, and treated with a weak solution of ⅛ ounce bichromate of potassa in 10 quarts water. The color becomes now dark black, when the wool is washed with water and dried.

2574. Persoz's Aniline Black for Wool or Silk. Steep the silk or wool for 1 hour at a boiling heat, in a bath consisting of 5 grammes (77 grains) bichromate of potassa, 3 grammes (46 grains) sulphate of copper, and 2 grammes (31 grains) oil of vitriol, for each litre (2$\frac{1}{10}$ pints) of water used. It is then thoroughly washed, and afterward passed through a solotion of oxalate of aniline marking 1° to 2° Baumé, in which it at once assumes a black color. In case the fabric contains a vegetable fibre, the first bath must be replaced by a series of baths resulting in chromate of lead. This is effected by successive passages through a solution of nitrate or acetate of lead, then through a hot one of sulphate of soda; and lastly through a cold bath of from 5 to 20 grammes (77 to 300 grains) bichromate of potash to the litre (2$\frac{1}{10}$ pints) of water.

2575. To Prepare Magenta for Dyeing. This color, which is also called rosein, fuchsine, and aniline red, is the best known of the series. It is better adapted for the preparation of a liquid dye than any other. In the hands of the amateur it can be used with economy, and the results obtained are generally satisfactory. It is readily soluble in alcohol, and to some extent in water. The latter property is taken advantage of by dyers, the dye bath being prepared directly from the crystals. It is, however, preferable to use alcohol for dissolving the color, as the solubility in water is not always the same with different samples. To 1 pound of the crystals add 2½ gallons of spirit .8200 specific gravity. The solution may be conveniently made in an ordinary 5-gallon tin. Agitate frequently, and add 2½ gallons of hot water. This product will be suitable for sale as a liquid dye, but for dyers' use, where a large quantity of water is admissable, 1½ gallons of spirit will be found sufficient. It is sometimes necessary to filter before using.

2576. To Dye Silk or Wool Magenta. Sufficient water to cover, without difficulty, the fabric to be dyed, is brought to a temperature of about 170° Fahr.; a sufficient quantity of the dye is added, and followed by the immersion of the goods, which should be moved about to prevent streaks. About half an hour's immersion is sufficient. Half an ounce of the crystals should give a fair shade to 10 pounds of wool. A bath of soap-suds is sometimes employed instead of water, and by the use of alkali, brighter, but perhaps less permanent colors are produced. Acids render the shade dull and bluish.

2577. To Dye Cotton Magenta. Place the cotton in a bath of sumach (1 pound sumach to 10 pounds cotton) for 2 hours. Wring out, and dye in the same manner as wool. (*See previous receipt.*) A brighter shade is given by dissolving ½ ounce soap in hot water, letting the solution cool to 90°, adding 2½ ounces olive oil, and mixing with tepid water. In this 5 pounds of cotton may be worked for about 5 minutes. A bath containing ¼ pound sumach and 1 ounce tin crystals is next prepared, through which the cotton should be passed, wrung out, and finally dyed in a bath of magenta and pure water.

2578. Aniline Cerise and Safranine. These colors resemble magenta in appearance, and appear to be varieties of that substance. They are readily soluble in alcohol, and more or less so in water. The colors produced are similar to those obtained from safflower, but possess greater vivacity and permanence. The shades are exceedingly delicate and beautiful, inclining to pink with a shade of yellow. The dye bath is prepared, and the fabric dyed, in the same manner as magenta. (*See Nos.* 2575, *&c.*)

2579. To Dye Aniline Yellow. This color is slightly soluble in water, and for dyers' use may be used directly for the preparation of the dye bath. It is, however, preferably prepared in a liquid state, by dissolving 1 pound of dye in 2 gallons of alcohol. (*See No.* 2575.) Without any addition to the dye bath very good yellows may be produced, but the color is much improved and brightened by a trace of sulphuric acid. The temperature of the bath should be under 200° Fahr.

2580. Schiff's Aniline Yellow. This matter, according to Schiff, is easily prepared by means of hydrated antimonic or stannic acid. Stannate of soda or other alkaline antimoniate or stannate is to be pounded with half its weight of aniline to a clear pulpy consistence, then hydrochloric acid is added till the acid reaction takes place. It is then shaken up, and the scarlet color removed by etherized alcohol, the mass being, of course, previously dried. After proper purification it is allowed to evaporate spontaneously, and in this way are formed flakes of a hydrochlorate, having for base a red coloring matter, which must not be confounded with rosaniline. When this hydrochlorate is decomposed by alkalies, deep yellow flakes are deposited, which again become red in presence of acids. By impregnating silk or wool with this red color, and then passing it into a hot solution of carbonate of soda, a beautiful yellow tint is developed, similar to the yellow of picric acid, and which M. Schiff claims to possess considerable stability.

2581. To Dye with Aniline Crimson. A solid dye, belonging to the same series as the preceding, is sold as crimson, but it does not appear to differ very materially from magenta, giving shades with a trifle less blue. It is applied in the same manner as magenta. (*See Nos.* 2575, *&c.*) Much better colors are obtained by the use of aniline yellow (*see No.* 2579) and magenta. The former may be applied in the manner indicated for that color, and the fabric so dyed must be passed through a bath of magenta until the required shade is produced. By mixing the liquid yellow and magenta dyes in a bath of soap-suds, nearly every shade from magenta to orange may be obtained. This will be found a satisfactory method for amateurs.

2582. **To Prepare Aniline Scarlet Dye.** To produce this color, aniline scarlet dye may be used. Neither this nor coralline is adapted for amateur use, as great exactness is required in compounding the dye bath. For the use of amateurs, aniline yellow and magenta, as indicated for crimson (*see No.* 2581) is recommended. To produce scarlet the yellow should predominate, or the bath may be rendered slightly sour by sulphuric acid. Aniline scarlet dissolves easily in water, and the bath may be made directly from the solid substance. A liquid dye may be made, if desired, by dissolving 1 pound scarlet in 4 gallons water and 1 gallon alcohol.

2583. **To Dye with Aniline Scarlet.** Add to the bath containing the dye, an excess of alum and cream of tartar; neutralize carefully by carbonate of soda—the exact point may be known by the liquid changing from a yellowish to a pinkish red.

2584. **To Dye Aniline Scarlet.** For every 40 pounds of goods, dissolve 5 pounds white vitriol (sulphate of zinc) at 180° Fahr., place the goods into this bath for 10 minutes, then add the color, prepared by boiling for a few minutes, 1 pound aniline scarlet in 3 gallons water, stirring the same continually. This solution has to be filtered before being added to the bath. The goods remain in the latter for 15 minutes, when they have become browned, and must be boiled for another half hour in the same bath, after the addition of sal ammoniac. The more of this is added the redder the shade will become.

2585. **To Prepare Coralline Dye.** Dissolve 1 pound coralline in 1½ gallons alcohol specific gravity .8200, by the aid of heat; mix the solution with 7½ gallons boiling water, and re-dissolve the precipitated dye by the cautious addition of water of ammonia.

2586. **To Dye with Coralline.** Add the color prepared as in No. 2585, to the dye bath, and neutrallize with acetic acid. The exact point is indicated by the pink color of the solution changing to an orange red. Immerse the goods, and, when the required color is obtained, remove and wash in a bath of soap-suds.

2587. **Water-Glass as a Solvent of Coralline.** Dissolve coralline in a boiling mixture of 1 part concentrated water-glass (silicate of soda or potassa of the consistency of a thick syrup), and 4 parts water, and, after cooling, apply this solution as a paint for wood (white woods containing little or no tannic acid are preferable), paper, toys, artificial flower tissues, &c., to all of which materials this solution of coralline imparts a beautiful carmine red tint.

2588. **Preparation of Innoxious Coralline.** M. Guyot states that coralline is frequently poisonous, because the rosolic acid, used to obtain it, contains phenol (carbolic acid), and this dangerous quality in the product can only be avoided by using the exact proportions necessary, in manufacturing the compounds.

2589. **To Prepare Aniline Brown for Dyeing.** This color may be used as a liquid dye, and for this purpose 1 pound of the brown may be dissolved in 2 gallons of spirit specific gravity 8200.

2590. **To Dye with Aniline Brown.** Add a sufficient quantity of the dye, prepared according to the previous receipt, to the dye bath, and immerse the fabric. Wool possesses a very strong affinity for this color, and no mordant is required. A snuff brown, more or less deep, is produced.

2591. **To Prepare Bismarck Brown for Dyeing.** Mix together 1 pound Bismarck, 5 pounds water, and ¾ pound sulphuric acid. This paste dissolves easily in hot water and may be used directly for dyeing. A liquid dye may be prepared by making the bulk of the above mixture to 2 gallons with alcohol.

2592. **To Dye Wool Bismarck Brown.** Render the bath, prepared as in No. 2591, sour with sulphuric acid; add a quantity of sulphate of soda, immerse the wool, and add the color by small portions, keeping the temperature under 212° Fahr. Very interesting shades may be developed by combining the color with indigo paste or picric acid. (*See No.* 2601.)

2593. **To Dye Cotton Bismarck Brown.** Cotton requires mordanting with sumach and acetate of alumina, and is dyed in a bath under 100° Fahr., prepared according to No. 2591. By the use of bichromate of potash redder shades may be obtained. The usual color inclines to cinnamon.

2594. **To Dye with Vesuvine.** This aniline color is prepared and used in the same manner as magenta. (*See No.* 2575, *etc.*)

2595. **To Dye with Aurine.** Dissolve 1 pound aurine in 2 gallons alcohol specific gravity .8200. This color is used principally for silk. Dye in a bath containing a trace of sulphuric acid. By combining with magenta (*see No.* 2575), very bright colors are produced.

2596. **To Dye with Palatine Orange.** The palatine orange dye is prepared in a similar manner to magenta. (*See No.* 2575.) Render the bath slightly acid by bichloride of tin, and dye at the boiling point. A very fast, but not very brilliant orange is produced. The color may be combined with magenta or indigo paste.

2597. **To Dye with Phosphine.** Phosphine is treated in the same way as palatine, omitting the sulphuric acid, and substituting a trace of carbonate of soda; or use a soap bath.

2598. **To Dye Silk with Aniline Green.** Iodine green, or night green, dissolves easily in warm water. For a liquid dye, 1 pound may be dissolved in 1 gallon alcohol, and mixed with 2 gallons of water containing 1 ounce sulphuric acid. This color is almost always a failure in the hands of the amateur, and is not recommended. For silk, no addition to the dye bath is required, the temperature being kept under 180° Fahr.

2599. **To Dye Wool with Aniline Green.** For wool, prepare two baths, one containing the dissolved dye and a quantity of carbonate of soda, or borax. In this the wool is placed, and the temperature raised to 212° Fahr. A grayish green shade is produced, which must be brightened and fixed in a second bath of water at 100° Fahr., to which some acetic acid has been added. Cotton requires preparation by sumach. (*See No.* 2577.)

2600. To Dye with Iodine Green. Mix 3 pounds of iodine green paste well with about 2¼ pounds of cold water; then add successively, 1 pound acetic acid 8° Baumé, 80 pounds water of a temperature of 140° Fahr, and 2 pounds liquor ammonia, stirring the mixture well all the while, and filtering it before use. Bring the dye bath to the boiling point; put in as much of the solution as is necessary for the shade required, and dye for half an hour, letting the bath cool off in the meantime. Then have a second water bath of 140° Fahr. ready, prepared as follows, viz.: For every 20 pounds of wool, add ½ pound sulphuric acid 66° Baumé, and ⅓ pound perchloride of tin crystals, the latter previously dissolved in an equal quantity of water. Take the goods from the first bath, without washing, into the second bath, turn them in it for 15 minutes, and the green will develop vividly. For yellowish tints, shade off with picric acid (*see No.* 2601), which must be added to the second bath and dyed quickly. By this method, 1 pound of iodine green paste will dye 12 pounds of wool a medium shade. Preserve the first bath, inasmuch as one-third of the dye remains in it, which circumstance is important in renewing the bath, which will, consequently, require one-third less dye-stuff when making it for the second lot.

2601. To Dye with Picric Acid. Dissolve 1 pound picric acid in 1 gallon of alcohol specific gravity .8200. The dye bath requires no addition, or special precaution. This color is used to produce shades of lemon and canary which cannot be attained by the aniline yellow or phosphine. Its chief use is for dyeing green. For this purpose pass the fabric through a bath containing sulphuric acid and alum, adding, after thorough immersion, a sufficient quantity of solution of picric acid and indigo extract (*see No.* 99) to produce the desired shade.

2602. To Dye with Aniline Blue. To 100 pounds of fabric dissolve 1¼ pounds of aniline blue in 3 quarts hot alcohol; strain through a filter, and add it to a bath of 130° Fahr., also 10 pounds Glauber's salts and 5 pounds acetic acid. Enter the goods, and handle them well for 20 minutes; next heat it slowly to 200° Fahr.; then add 5 pounds sulphuric acid diluted with water. Let the whole boil 20 minutes longer, then rinse and dry. If the aniline be added in two or three proportions during the process of coloring, it will facilitate the evenness of the color. The blue, or red shade of blue, is governed by the kind of aniline used, as there is a variety in the market. Hard and close-wove fabrics, such as braid, ought to be prepared in a boiling solution of 10 pounds sulphuric acid and 2 pounds tartaric acid before coloring with the aniline, as this will make the fabric more susceptible to the color. Blues soluble in water color more easily than those which have to be dissolved in alcohol.

2603. To Dye Silk or Wool with Aniline Blue. In this manner are used the varieties of aniline blues known as *Bleu de Lyon, Pure Blue, Red Blue,* and all others soluble in alcohol. Into a stone jar fitted with a cover, through which a hole is made to admit a stick for stirring, put 1 pound of the dye, 5 gallons alcohol specific gravity .8200, and 2 ounces sulphuric acid; apply the heat of a water bath and stir frequently. After allowing the mixture to cool, filter, and treat any undissolved residue with fresh alcohol until complete solution is effected. From 5 to 8 gallons will be required. The dye bath for wool should be rendered sour by sulphuric acid. Tin crystals may be used, in quantity equal to about $\frac{1}{40}$ the weight of the wool, to improve the vivacity of the shade. The bath should be brought to the boiling point. For silk, prepare a soap bath, add the color, and put in the goods. When dyed sufficiently, pass through a bath acidulated with sulphuric acid.

2604. To Dye Cotton with Aniline Blue. Cotton is prepared as for magenta (*see No.* 2577), and dyed in an acid bath as for wool. (*See No.* 2603.)

2605. To Dye with Aniline Water-Blue. This color is quite soluble in water, and will answer well for preparing a liquid dye; 1 pound may be dissolved in a mixture of 1 gallon alcohol and 4 gallons water. Dyers dissolve the powder in the dye bath. The dye is used in the same way as Bleude Lyon. (*See No.* 2603.)

2606. To Dye with Alkali Blue and Nicholson's Blue. Dissolve 1 pound of the dye in 10 gallons boiling water. Add this, by small portions, to the dye bath, which should be rendered alkaline by borax. The fabric should be well worked about between each addition of the color; the temperature must be kept under 212° Fahr. If the right proportion of borax has been used the goods will show but little color when removed from the bath. To develop this, wash with water and pass through a bath containing sulphuric acid.

2607. To Dye with Aniline Violet and Purple. The various aniline purples known as *Parme, Violet de Fuchsin, Victoria Violet,* and *Amaranth,* are used in the same manner as Bleu de Lyon (*see No.* 2603), omitting the sulphuric acid. Acidulate the bath by sulphuric acid, or use sulphate of soda; both these substances render the shade bluish. Dye at 212°. To give a fair middle shade to 10 pounds of wool, a quantity of solution equal to ½ to ¾ ounce of the solid dye will be required. The color of the dyed fabric is improved by washing in soap and water, and then passing through a bath soured by sulphuric acid. According to Mr. Hirsch, cotton is treated as follows: Prepare the goods for fuchsine, and turn them over a few times in a tepid solution of 2¼ ounces crystallized perchloride of tin, for every 10 pounds of goods. Remove the latter, add as much violet solution as the shade requires, dye for a quarter of an hour, wring well, and dry. Washing in a solution of alum and starch will render the color more solid.

2608. To Dye with Hoffman's Purple. The dye is prepared as other purples. (*See No.* 2607.) Some authorities maintain that this color does not require the addition of acid to the dye bath, but the color is apt to rub off when dyed in this manner. A trace of tartar, or of tartaric, oxalic, or any vegetable acid may be used with advantage; but mineral acids are to be particularly avoided. The bath should be kept at a boiling temperature.

2609. To Dye Woolens Blue with Aniline. To the water in the vat sulphuric acid is added in sufficient quantity to cause it to taste as acid as vinegar; it is then brought to boiling, and kept so for 10 minutes; some blue aniline liquor is then added with stirring; the goods are submerged, and kept under while boiling until the water has lost its color; after which they are removed, fresh liquor is added, and the process continued until the desired color has been given, the water being kept constantly at a boil. (*See No.* 333.)

2610. To Dye Silk Blue with Aniline. Silk is steeped first for an hour in lukewarm water, acidulated with sulphuric acid, as for woolens in the last receipt, and the color must be added in 4 to 5 small portions, raising the temperature gradually to boiling, and continuing it at that, when a good color has been obtained, for some 5 to 10 minutes. The old bath is then replaced by fresh water, which is acidified with sulphuric acid, and in which the silk is boiled for 10 minutes; after which it is thoroughly washed in water and then in suds, afterwards again in water, then once more drawn through acidulated water, and lastly through water alone. (*See No.* 333.)

2611. To Dye Silks or Woolens Violet or Purple with Aniline. Violets and purples are produced on wool in the same manner as the blue; on silk the same method is used likewise, but the water must only be heated short of boiling. (*See Nos.* 315 *and* 316.)

2612. Jacobson's Method of Combining Fat and Oil with Aniline Red. The following process is given for this purpose by Dr. E. Jacobson. First separate rosaniline from commercial fuchsine by heating with soda or digestion with ammonia; wash and dry it. An oleate or stearate of rosaniline is next obtained by adding the rosaniline to oleic acid or melted stearic acid as long as it will dissolve, or by putting them together in equivalent proportions. An excess of oleic acid must be avoided when the compound is required for a varnish, as it delays the drying. Oleate or stearate of rosaniline easily dissolves in fats or oils, and colors these an intense red. If it is wanted for a linseed oil varnish, the linseed oil must be free from lead. The compound must be kept from the fire, or it soon turns blue, probably by the reducing action of the fatty acids. The best red color is obtained in linseed oil varnish. Stearine with oleate or stearate of rosaniline appears a bluish red. Paraffine appears to act as a reducing agent with the compounds of fatty acids and aniline, and changes to a dirty violet color; the mixture then is inapplicable to the coloring of paraffine or stearine candles. The oleate or stearate of rosaniline is a good coloring agent for hair oil or pomatum, but, from the instability of the color, seems inapplicable for oil painting.

2613. Dyeing with Fuchsine on Wool or Silk. Fuchsine (the crystals of acetate of rosaniline), or the solution, is mixed with cold water for silk, or in water of 130° to 140° Fahr. for wool, which temperature is kept up. For silk, a few drops of acetic acid are also added. The strength of the dye regulates the quantity which is required. The goods are merely immersed in the bath until they have taken up sufficient of the color; it is not always advisable to work them about while in the bath.

Liquid Colors for Various Purposes.

These receipts include the preparation and appliance of such liquid colors as are used to tinge or impart color to matter generally. Their particular uses and appliances are specified in the receipt given for each preparation. In addition to those here given, a number of other receipts for coloring matter have been necessarily included under the respective headings of the special objects for which they are used, and will be readily found by consulting the index.

2615. Soluble Prussian Blue. Add a solution of protosulphate of iron to a solution of prussiate of potash, and expose the precipitate to the air till it becomes blue, and wash it till the soluble salts are washed away. By continuing the washing, the blue itself dissolves, forming a deep blue solution, which may be evaporated without decomposition. Or, add a solution of persulphate of iron to a solution of ferroprussiate of potash, keeping the latter in excess; wash the precipitate until it begins to dissolve, and dry it. (*See No.* 2488 *for another method.*)

2616. Chemique, or Chemic Blue. Sulphate of Indigo. To 7 or 8 parts of oil of vitriol, in a glass or earthen vessel, placed in cold water, add gradually 1 part of fine indigo in powder, stirring the mixture at each addition with a glass rod or piece of tobacco-pipe. Cover the vessel for 24 hours, then dilute with an equal weight of water. Sometimes it is sold without diluting. The German *fuming acid* answers best, 4 or 5 parts of it being sufficient for 1 of indigo. For dyeing silk, &c., carbonate of potash, soda, or ammonia, is added, to neutralize the acid, taking care not to add it in excess. (*See Nos.* 98 *and* 4791.)

2617. Liefchild's Patent Blue for Linen. Mix 4 parts Chinese blue, 1 of Turnbull's blue, and 1 of oxalic acid; gradually add boiling water until the whole is dissolved, and lastly 4 parts of sulphate of indigo. The latter is made with 1 part indigo, and 4 sulphuric acid, neutralized with carbonate of ammonia.

2618. Blue for Linen. The ordinary kinds of cake blue consist of indigo and starch.

2619. Solvents for Indigo. Indigo will dissolve in Venice turpentine heated to its boiling point, or in boiling paraffine, with the same blue color as the solution of sulphuric acid; and in petroleum it forms a carmine solution, while in spermaceti it produces a carmine-violet, and in stearic acid a blue color.

2620. Bluing for Clothes. Take 1 ounce of soft Prussian blue, powder it and put in a bottle with 1 quart of clear rain water, and add ¼ ounce of oxalic acid. A tea-spoonful is sufficient for a large washing.

2621. Purified Annotto. To a boiling solution of pearlash add as much annotto as it will dissolve. When cold, decant the clear solution, and neutralize with diluted sulphuric acid, avoiding any excess. Wash the precipitate with a little cold water, and dry it.

2622. Solution of Annotto. Boil equal weights of annotto and pearlash with water, and dilute to the required color.

2623. Cochineal Coloring. Take 1 ounce each powered cochineal, carbonate of potash, bitartrate of potash, and alum; boil these in a glazed vessel with 7 ounces water and 1 ounce spirit of wine, until effervescence ceases (about 10 minutes). In this liquid dissolve an equal weight of refined sugar by means of sufficient heat, and set aside for use. This coloring remains bright for any length of time, does not throw down any precipitate, and is almost unalterable by contact with either acids or alkalies, which is no small advantage. Dickson's coloring has some disadvantages in the large quantity of spirit and the delicacy of the ammonia tint. The first would have a tendency to cause a cloudy appearance in bright jellies and other preparations containing gelatine, and the ammonia color would be liable to be completely changed when brought in contact with lemon juice, baked pears, and other acids met with in the many culinary purposes for which the article is largely used.

2624. Dickson's Cochineal Coloring. Mix together 2 ounces spirit of wine and 6 ounces water. In 3 ounces of this mixture infuse 1 ounce powdered cochineal for 15 minutes, in a flask heated to nearly boiling point. Pour the infusion into another vessel, and repeat the process with 3 ounces more of the mixed spirit and water; and a third time, with the remaining 2 ounces. Let the liquid stand till cold, when some fatty matter will rise to the surface; filter, adding spirit and water, up to eight fluid ounces. Lastly, add sufficient strong water of ammonia to change the infusion to the desired tint. The coloring is thus prepared without carbonate of potash, alum, etc., and is free from the objections that attach to the coloring obtained by the aid of those substances. (*See last receipt.*) These objections are:—1st, the coloring matter is thrown down as a lake, and after some time forms a layer at the bottom of the containing vessel, requiring the addition of ammonia to re-dissolve and keep it in solution; and—2d, it does not keep well. On the other hand, the advantages of Dickson's preparation are:—1st, the coloring-matter remains in solution, and —2d, it keeps well, and has no unpleasant odor.

2625. Cochineal Coloring. Macerate 1 ounce best carmine in 6 ounces strong solution of ammonia, until it is dissolved. Heat *gently* to drive off excess of ammonia, taking care not to carry it too far, so as to precipitate the carmine. Put into a quart wine bottle, and add 4 ounces rectified spirit and 3 pounds white sugar. Fill up with warm water, and shake until the sugar is dissolved. This is a splendid coloring.

2626. Black Lustre Color for Paper, Cloth, or Wood. Dr. Kielmeyer gives a receipt which is adapted for either paper, cloth, or porous wood. He states that it stands well, is very supple, and has no tendency to get sticky. To prepare it, boil together 8 pounds glue, previously dissolved in 16 pounds water; 1 pound potato starch, dissolved in 5½ pounds water; 5¼ pounds campeachy extract of 6° Baumé; 1 pound 2 ounces green vitriol, and 8¾ pounds brown glycerine. When thoroughly mixed, remove the pot from the fire, and continue to stir until the liquid is cold. If the paint be desired thicker or thinner, the amount of starch and glue must be varied as well as the other materials, or the lustre will suffer.

2627. Black Produced by the Mixture of Colorless Liquids. One of the most interesting phenomena in the operations of chemistry occurs in the decomposition of sulphate of iron by gallic acid. Into a wine-glass, containing the infusion of galls, pour a solution of the sulphate of iron. The gallic acid, from its superior elective affinity to the iron, detaches it from its former combination with the sulphuric acid, and in a short time these two fluids, previously colorless, become intensely black. To make this black fluid into ink, nothing but a little gum is required, to retard the precipitation of the coloring matter.

2628. To Make Liquid Blue. Put into a bottle 1 ounce pure Prussian blue, in fine powder, and pour upon it 2 ounces concentrated hydrochloric acid. Effervescence ensues, and the mixture soon assumes the consistence of a thin paste. Leave it for 24 hours, and then dilute with 8 or 9 ounces water, and bottle it. The whole may be further diluted with a quart of water and still retain a sufficiently dark color for washing muslins, etc. The common blue writing fluid is thus prepared.

2629. Carmine Purple. The dye recently invented, and known as carmine purple, is obtained by the solution of uric acid in nitric acid, care being taken to prevent boiling over and too great an increase of temperature. The mixture should remain standing quietly for some days, after which a thick, pasty, or doughy substance is obtained, which is to be treated with warm water, filtered, and the residuum again treated with warm water. The filtered liquid possesses a reddish or yellowish color, resulting from the organic substances decomposed by the nitric acid. It is next to be evaporated in a large enameled iron vessel, but not heated to the boiling point, which would destroy the murexide (carmine purple) produced. After the liquid has been evaporated to a syrupy consistency, and has assumed a beautiful brownish-red or violet color, it is to be allowed to cool. The entire quantity of the liquid should never be evaporated at one time, nor heated to the boiling point.

2630. To Color with Alkanet Root. Anchusa Tinctoria gives a fine red tinge to oils, fats, wax, turpentine, spirits, essences, etc., and is used to color hair oil, pomatums, ointments, varnishes, etc. The spirituous solution stains marble of a deep red; wax tinged with alkanet and applied to warm marble, leaves a fresh color.

2631. To Color with Mallow or Malva Flowers. The mallow or malva flower is a native of Europe, growing abundantly on waste grounds and by the waysides. It is also sometimes cultivated in this country. This flower, which gives a beautiful color to water, is used for coloring port and claret wines, and it is considered one of the best articles that can be employed for that purpose. Weigh 2 pounds, and steep the red petals in cold water for 5 or 6 hours. Tartaric acid mixed with the mallow gives a bright red color, and salt of tartar (carbonate of potassa) a deep purple red.

2632. To Purify Caramel. The caramel of commerce is spirit coloring, or a solution of burnt sugar in water. (*See No.* 694.) In this state it is mixed with variable quantities of undecomposed sugar and certain bitter compounds. To render it quite pure, it should be dissolved in water, filtered, and alcohol added until it ceases to produce a precipitate. The caramel is thus thrown down, while the impurities remain in solution. Pure caramel is a black or dark brown powder, soluble in water, to which it gives a rich sepia tint; it is insoluble in alcohol, and incapable of fermentation.

2633. Blue Dye from Molybdenum. According to late experiments by Professor Boettger, based upon some previous researches of Dr. Schönn, if molybdic acid be dissolved to saturation in concentrated sulphuric acid with heat, an uncolored clear fluid is obtained, forming a double acid of sulphuric and molybdic acid. If a little of this double acid be placed in a porcelain dish and heated till it begins to throw off white vapors, and then a certain quantity of absolute alcohol be gradually added, a beautiful blue color is developed, as if by magic, by means of which silk can be dyed without the use of any mordant.

2634. Mordants. Substances employed to fix the coloring matters of dye-stuffs on organic fibres, and to give them brilliancy and permanency. This they effect, either by their strong affinity for the fibre and the dye matter, serving as a bond of union between the two, or by uniting with, and rendering insoluble, the dye contained in the pores of the fibre. The principal mordants are alum, and the oxides of iron or tin. (*See No.* 93.)

2635. To Color Butter. Pure annotto, when properly prepared, is very successfully used for imparting a good color to fall and winter butter. (*See No.* 2621.) Annotto of course adds nothing to the flavor or quality of butter, but as the pure article, when thus employed for coloring, is quite harmless, there can be no serious objection to its use. In coloring butter with annotto it is important that a prime article be used, and to have it prepared so that it shall be free from sediment and adulteration.

2636. To Color Pickles and Sweetmeats Green. A beautiful green color, entirely destitute of any poisonous qualities, may be made by dissolving 5 grains saffron in ¼ ounce distilled water, and in another vessel dissolving 4 grains indigo carmine in ½ ounce distilled water. After shaking each up thoroughly they are allowed to stand for 24 hours, and on being mixed together at the expiration of that time a fine green solution is obtained, capable of coloring 5 pounds of sugar.

2637. Chameleon Mineral. Mix equal weights of black oxide of manganese and pure potash, and heat them in a crucible. Keep the compound in closely-stoppered bottles. A solution of it in water passes through various shades of color from green to red.

2638. Cadmium Yellow Color for Soap. The chemical works of Schering, in Berlin, have introduced two shades of sulphide of cadmium, a lemon and orange yellow, for the coloring of toilet soap. Of all the agents thus far tried to give a lively yellow color to soap, sulphide of cadmium (cadmium yellow) has proved the most permanent. Age and sunlight do not affect the color, and the quantity required is exceedingly small.

2639. To Color Soap Yellow with Cadmium. The cadmium yellow (*see above*) is rubbed up with oil, and added to the soap under constant stirring. The color is not dissolved in the soap, but suspended in it, and much depends upon careful mixing.

2640. Liquid Colors. The following, when thickened with a little gum, are used as inks for writing, as colors to tint maps, foils, paper, artificial flowers, &c., and to paint on velvet. Some of them are very beautiful. It must be observed, however, that those made with strong spirit do not mix well with gum, unless diluted with water.

2641. Liquid Blue. Dissolve litmus in water, and add ⅛ of spirit of wine. Or, dilute Saxon blue or sulphate of indigo with water. If required for delicate work, neutralize the acid with chalk. Or, to an aqueous infusion of litmus add a few drops of vinegar till it turns full blue.

2642. Liquid Purple. Steep litmus in water, and strain. Or, add a little alum to a strained decoction of logwood. Or, add a solution of carmine (red) to a little blue solution of litmus or Saxon blue.

2643. Liquid Green. Dissolve crystallized verdigris in water. Or, dissolve sap green in water, and add a little alum. Or, add a little salt of tartar to a blue or purple solution of litmus, till it turns green. Or, dissolve equal parts of crystallized verdigris and cream of tartar in water, and add a little gum-arabic. Used as an ink for writing.

2644. Liquid Yellow. Dissolve gamboge in water, and add a little gum-arabic and alum. Used for ink, to stain paper, color maps, &c. Or, dissolve gamboge in equal parts of proof spirit and water. Golden colored. Or, steep French berries in hot water, strain, and add a little gum and alum. Or, steep turmeric, round zedoary, gamboge, or annotto, in spirits of wine. Or, dissolve annotto in a weak lye of subcarbonate of soda or potash. The above are used by artificial florists.

2645. Liquid Red. Macerate ground Brazil in vinegar, boil a few minutes, strain, and add a little alum and gum. Or, add vinegar to an infusion of litmus till it turns red. Or, boil or infuse powdered cochineal in water; strain, and add a little alum and gum. Or, dissolve carmine in liquor of ammonia, or in weak carbonate of potash water; the former is superb. (*See No.* 2623, *&c.*)

2646. To Tint Maps or Architects' Plans. Maps, paper, or architects' plans may be tinted with any of the simple liquid colors just mentioned. To prevent the colors sinking and spreading, which they will usually do on common paper, the latter should be wetted 2 or 3 times with a sponge dipped in alum water (3 or 4 ounces to the pint), or a solution of white size; observing to dry it carefully after each coat. This will tend to give lustre and beauty to the colors. The colors themselves should also be thickened with gum. Before varnishing maps after coloring them, 2 or 3 coats of clean size should be applied with a brush.

2647. Sizing for Prints or Engravings to be Colored. Dissolve 4 ounces finest pale glue, and 4 ounces white curd soap, in 3 pints boiling water; add 2 ounces powdered alum. Used for sizing prints and engravings before coloring them.

2648. Druggists' Show Colors. These are bright and perfectly transparent liquid colors, employed by druggists in ornamental bottles for purposes of display, forming an attractive and distinctive ornament of a drug store window. It has for a long time been tried to render the beautiful colors of permanganates more permanent. They are liable to decompose under the influence of light and atmospheric dust, and no way has as yet been discovered to obviate this difficulty. Many druggists have proposed to fill the bottles in their windows with solutions of aniline colors, but even these have to be renewed from time to time. Neutral metallic salts, that have neither tendency to oxydize nor to reduce, are best employed for this purpose. The receipts here given are among the very best and most used for this purpose. The mixtures require careful filtration through powdered glass in a glass funnel. It will be found desirable to make a little more liquid color than is actually required, to replace the loss occasioned by a second filtration (performed in the same manner as the first), which will probably be necessary after exposure for a few weeks to the light; as any addition of water *after filtration,* to make up the deficiency, tends to weaken the color and detract from its brightness. Druggists' show-bottles are now made of colored glass, and filled with pure water. These are just as effective as the white glass bottles filled with colored waters, and obviously involve much less trouble.

2649. Amber. Digest 1 part dragon's blood, coarsely powdered, in 4 parts oil of vitriol; when completely dissolved, dilute with distilled or soft water to the desired shade, and filter. (*See No.* 2648.)

2650. Indigo Blue. Dissolve indigo in sulphuric acid, and dilute with pure water to the required shade of color; filter as directed in No. 2648.

2651. Blue. Dissolve 2 ounces sulphate of copper in ½ ounce oil of vitriol and 1 pint of pure water; filter as in No. 2648.

2652. Prussian Blue. Dissolve pure Prussian blue in slightly diluted oxalic or muriatic (hydrochloric) acid; add water to bring the color to the desired shade, and filter. (*See No.* 2648.)

2653. Pink. To a solution of chloride or nitrate of cobalt in water, add sufficient sesquicarbonate of ammonia to dissolve the precipitate at first formed. Filter as in No. 2648. Or: Wash 1 ounce madder in cold water; digest it, with agitation, for 24 hours in 3 pints water containing 4 ounces sesquicarbonate of ammonia; then dilute with water to the desired shade, and filter as above.

2654. Purple. To an infusion of logwood, add sufficient carbonate of ammonia or of potassa to make the color. Filter as directed in No. 2648. Or: To an infusion of cochineal, add sufficient sulphate of indigo, nearly neutralized with chalk. Filter as above.

2655. Red. Dissolve carmine in aqua ammonia and dilute with water to the desired shade; filter as in No. 2648. Or: Dissolve madder lake in a solution of sesquicarbonate of ammonia, and dilute with water; filter as above.

2656. Violet. Dissolve nitrate of cobalt in a solution of sesquicarbonate of ammonia; add sufficient ammonio-sulphate of copper to produce the color. Filter as in No. 2648.

2657. Yellow. Dissolve ½ pound sesquioxide of iron (rust of iron), in 1 quart muriatic (hydrochloric) acid; dilute with water, and filter. (*See No.* 2648.) Or: Dissolve chromate or bichromate of potash in distilled water; or equal parts of either the above and of nitre (saltpetre) dissolved in water, and filtered as above.

2658. Crimson. To 1 ounce alkanet root add 1 pint oil of turpentine. Filter as directed in No. 2648. This is used chiefly for lamps.

2659. Green. Dissolve 2 ounces blue vitriol (sulphate of copper) in 1 pint water; add sufficient bichromate of potassa to turn the liquid green. Or: A solution of 2 ounces blue vitriol (sulphate of copper), and 4 ounces chloride of sodium, in 1 pint of water. Or: A solution of distilled verdigris, in acetic acid, and diluted with water. Or: Dissolve blue vitriol in water as above, and add nitric acid till it turns green. All these must be filtered as directed in No. 2648.

2660. Lilac. Dissolve crude oxide of cobalt in nitric or muriatic (hydrochloric) acid; add sesquicarbonate of ammonia, in excess; afterwards sufficient ammonio-sulphate of copper to produce the color required. Filter. (*See No.* 2648.)

2661. Olive. Dissolve equal parts by weight of sulphate of iron, and oil of vitriol, in water; add sufficient nitrate of copper to produce the color. Filter as in No. 2648.

2662. Orange. A solution of bichromate of potassa in water, either with or without the addition of some hydrochloric or sulphuric acid. Or: Dissolve gamboge or annotto in liquor of potassa; dilute with water and add a little spirit. Filter these as directed in No. 2648.

2663. Sea Green. To 1 gallon water add acetate of copper, 4 drachms; and acetic acid, 4 ounces.

2664. Pea Green. To 1 gallon water add nickel, 2 drachms; acetic acid, 1 ounce; and bichromate of potash, ½ drachm. Or: To 1 gallon diluted alcohol, add sulphate of copper and common salt, of each 2 ounces.

2665. Light Blue. To 1 gallon of water add sulphate of copper, 16 ounces.

2666. Light Green. Sulphate of copper (re-crystallized), muriatic acid (free from iron), water, alcohol, of each a sufficient quantity.

2667. Violet to Purple. To the green acid solution of sulphate of chromium add strong solution of ammonia, and filter as directed in No. 2648.

2668. Yellow. Bichromate of potassa, muriatic acid, water, of each a sufficient quantity.

2669. Bright Red. Cochineal, ground, 1 ounce. Boil with 1 pint of water, replacing that which evaporates. Towards the close add cream tartar, ½ ounce; alum, 1 ounce; and when cold, oil of vitriol, 1 ounce, mixed with ½ pint of water.

2670. Purple to Pink. Fuchsine diluted with spirit, as desired.

2671. Magenta, Solferino, Water of the Nile, and other bright colors may be obtained by mixing the various aniline or tar colors with water as directed in No. 2497.

2672. To Prevent Show Colors Freezing. It will be sufficient to bring the solution to a strength of about 15 to 20 per cent. of alcohol. Naturally the liquids must be very dilute as regards the solids, so as to suffer no precipitation of any saline matter by cold or spirits. Acetate of copper, with or without ammonia, a dilute solution of iodine in iodide of potassium, nitrate of cobalt, etc., are not acted on by weak alcohol. We believe that glycerine may be mixed with water for this purpose, but whether it possesses any superiority over alcohol we have not been able to ascertain. The bottles in all cases must have sufficient space left over the fluids to allow for expansion.

Pigments. These are substances employed as coloring matter in mixing paints, &c. The following receipts furnish the method of preparing the pigments and other coloring matters in general use, and their special appliances.

2674. Turnbull's Prussian Blue. Ferricyanide (red prussiate) of potassium, 10 ounces; solution protosulphate of iron, 1 pint; water, 3 pints. Dissolve the ferricyanide of potassium in part of water, and add the solution, gradually, to the solution of protosulphate of iron previously diluted with the remainder of the water, stirring the mixture during the addition. Then filter the liquid, and wash the precipitate on the filter with boiling water until the washings pass nearly tasteless. Lastly, dry it, and rub it into fine powder. It may also be made by adding protosulphate of iron to a mixture of yellow prussiate of potash, chloride of soda, and hydrochloric acid. This, mixed with water, makes an excellent bluing.

2675. Prussian Blue. Percyanide, ferrocyanide, or ferroprussiate of iron. Commercial Prussian blue is made by adding to a solution of prussiate of potash (or of prussiate cake), a solution of 2 parts alum and 1 part sulphate of iron, washing the precipitate repeatedly with water to which a little muriatic acid has been added, and exposing it to the air till it assumes a deep blue color. A purer kind is made by adding a solution of persulphate or perchloride of iron to a solution of pure ferroprussiate of potash. (*See No.* 2674.)

2676. Action of Prussic Acid on Iron Solutions. The Germans call prussic acid blausäure, because it produces a blue precipitate in certain iron solutions; but the following experiment undoubtedly proves that the prussic acid does not produce the color of that precipitate, since it can be made just as well without it. Prepare a saturated solution of green vitriol in water. Take 4/7 parts of the above solution and treat it with nitric and sulphuric acids, until it is changed into the sulphate of peroxide of iron. Mix this with the remaining 3/7 of the first solution, then add very gradually (to avoid its becoming heated) concentrated sulphuric acid, until a precipitate is formed. The result will be a beautiful blue precipitate, equal to Prussian blue. If water is added, the precipitate is dissolved and the color destroyed; but if the precipitate is separated from the acid and rubbed with phosphate of soda, we obtain a beautiful blue phosphate of iron, which will resist the action of water. In all these cases the acids, which possess no color, are by no means the cause of the blue color, but favor only the production of it, by depriving the mixed hydrates of protoxide and peroxide of iron of certain equivalents of water, and likewise by preventing the same from entering into a higher state of oxidation in the atmosphere.

2677. To Make Carmine by the Langlois Process. Boiling river water, 4 gallons; cochineal in powder, 1 pound; boil for 10 minutes, then add ¾ ounce carbonate soda, dissolved in 1 pound water; boil again for ½ an hour; cool, add ¾ ounce alum in fine powder, agitate rapidly until it be dissolved, then let it stand for 20 minutes, after which carefully decant into another vessel. The white of 2 eggs, dissolved in 1 pint water, is now to be added, and the whole well agitated; apply heat until the liquor be clarified, then draw it off, and allow it to repose for ½ an hour, or longer, when the clear portion must be decanted, and the carmine that has been deposited at the bottom collected, and placed upon a filter to drain. When it has acquired the consistence of a paste, remove it from the filter with an ivory or silver knife, and finish the drying upon shallow plates, covered with silver paper.

2678. To Make Carmine by Cenette's Process. The following is the method employed by Madame Cenette: Finest cochineal, reduced to powder, 2 pounds; pure river water, boiling hot, 15 gallons; boil for 2 hours, then add refined saltpetre, bruised, 3 ounces; boil for 3 minutes longer, and add 4 ounces of salts of sorrel (binoxalate of potassa). Boil for 10 minutes longer, then remove the heat, and allow the liquor to settle for 4 hours, when it must be decanted with a syphon into shallow plates, and set aside for 3 weeks. At the end of this time, the film of mould formed on the surface must be dexterously and carefully removed, without breaking it or disturbing the liquid portion. The latter must be now removed with a syphon, and the remaining moisture drained off, or sucked up with a pipette. The carmine which is left behind must be dried in the shade, and will be found to possess extraordinary lustre and beauty.

2679. To Revive or Brighten Carmine. We may brighten ordinary carmine and obtain a very fine and clear pigment, by dissolving it in water of ammonia. For this purpose leave ammonia upon carmine in the heat of the sun till its color is extracted and the liquor has got a fine red tinge. It must then be drawn off and precipitated by acetic acid and alcohol, next washed with alcohol, and dried. Liquid carmine is a solution of carmine in ammonia.

2680. Adulteration of Cochineal. Genuine cochineal has a specific gravity of 1.25; it is commonly increased in weight by slightly moistening it with gum water, and then rouncing it in a bag, first with sulphate of baryta, and then with finely powdered bone-black. In this way its specific gravity is raised to 1.35, by introducing about 12 per cent. of useless matter.

2681. Kirchoff's Method of Making Vermilion. This is said to yield vermilion equal to the Chinese. Rub in a porcelain dish 100 parts mercury with 23 parts flowers of sulphur, moistening the mixture with a solotion of caustic potash. Next treat it with 53 parts hydrate of potash, mixed with an equal weight of water; warm it up and triturate it again. The water must be replaced as it evaporates, and the operation continued for 2 hours. The whole is now to be evaporated to a thin paste, during constant trituration, and the heat removed the moment the color is of a good tint. Even a few seconds too much or too little will injure the result. When cold, the mass is washed with a solution of potash, and afterwards with pure water, and finally dried.

2682. To Preserve Vermilion. It is a fact well known to artists that the splendidly bright color of vermilion (cinnabar, sulphide of mercury) has a tendency, especially if it has been mixed with white lead, to become blackish brown and very dark-colored in a comparatively short time. This tendency is altogether obviated if, previous to being mixed with oil, it is thoroughly and intimately mingled with flowers of sulphur, in the proportion of 1 part sulphur to 8 parts vermilion.

2683. Carthamine or Safflower Lake. Wash safflower till the water comes off colorless; mix it with water holding 15 per cent. of carbonate of soda in solution, so as to form a thick paste; leave it for several hours, then press out the red liquid, and nearly neutralize it with acetic acid. Next put cotton into it, and add successive small portions of acetic acid, so as to prevent the liquid becoming alkaline. In 24 hours take out the cotton, wash it, and digest it for half an hour in water holding 5 per cent. of crystallized carbonate of soda in solution. Immediately on removing the cotton, supersaturate the liquid with citric acid, and collect the precipitate, which must be repeatedly washed in cold water. For pink saucers the liquid is allowed to deposit in the saucers. Mixed with the scrapings of French chalk it constitutes rouge.

2684. Lakes are also obtained from Brazil-wood and madder, by adding alum to a concentrated decoction of the former, or to a cold infusion of the latter (made by triturating the madder, inclosed in a bag, with the water), and afterwards sufficient subcarbonate of potash or soda to throw down the alumina in combination with the coloring matter. The precipitate is to be washed and dried. A little solution of tin added with the alum improves the color. Lakes may be obtained from most vegetable coloring matters by means of alum and an alkaline carbonate. Yellow lake is made from French or Persian berries, by boiling them in water with a little soda or potash, and adding alum to the strained liquor as long as a precipitate is thrown down. Or by boiling weld, or quercitron bark, in water, and adding alum and chalk in a pasty state.

2685. Rose Pink. Boil 6 pounds Brazil-wood and 2 pounds peach-wood in water, with ¼ pound alum, and pour the strained decoction on 20 pounds sifted whitening.

2686. Sap Green. The expressed juice of buckthorn berries (and sometimes of other species of rhamnus, and also of privet berries) is allowed to settle, and the clear liquid evaporated to dryness. A little gum-arabic is sometimes added to the juice.

2687. Azure Blue, or Smalts. The common qualities are made by fusing zaffre (roasted cobalt ore calcined with siliceous sand) with potash. A finer quality is obtained by precipitating a solution of sulphate of cobalt, by a solution of silicate of potash. Another cobalt blue is obtained by adding a solution of phosphate of soda to a solution of nitrate of cobalt, and mixing the precipitate, washed, but not dried, with 8 times its weight of fresh hydrated alumina. When dry, heat it to a cherry red. It is permanent, but has little body. If ground too fine it loses its beautiful tint. It can be employed in fresco and silicious painting. It is not affected by sulphuretted hydrogen.

2688. Blue Verditer. It is generally stated to be made by adding chalk to a solution of nitrate of copper produced in the process of refining silver; but Mr. Phillips did not succeed in making it by this means, and found no lime in the best samples. This pigment is acted upon by suphurretted hydrogen; it should not be used in oil, and though more stable in water, it is hardly a pigment for high art work. Certain blues are made from the natural blue basic carbonate of copper, and from malachite, but they have no interest for the artist.

2689. New Blue. Mix equal parts of common arseniate of copper (*see Mineral Green, No.* 2711), and neutral arseniate of potash, fuse by heat in a large crucible, then add to the fused salt ⅛ its weight of nitre. Effervescence takes place, and the salt becomes blue. Cool, pulverize, and wash.

2690. Cobalt Blue. Thénard's blue is made by precipitating a soluble cobalt salt with a solution of alum, and heating the precipitate. When well made, it is a good permanent color, useful in oil and water. It can also be employed in fresco and silicious painting. It is, however, somewhat affected by light, losing its brilliancy slightly.

2691. Elsner's Preparation of Zinc Green. Sprinkle with water a mixture of 5 parts oxide of zinc and 1 part of sulphate of cobalt, dry the pulp thus obtained, then heat to redness. A deep green powder is obtained. If 10 parts oxide of zinc, and 1 part sulphate of cobalt be employed, the product is grass green in color; the same color, only lighter, is obtained when the latter proportion of zinc oxide is again doubled. These colors, especially the latter, may replace to advantage Schweinfurt green; they apply well on a coating of lime.

2692. Bistre. This is a brown color which is used in water-color painting. It is prepared from the root of beech-wood by washing away the soluble parts with water.

The insoluble residue is mixed with gum water and formed into cakes.

2693. **White Lead.** This pigment, which enters largely into the composition of various colored paints, is carbonate of lead, obtained by suspending rolls of thin sheet lead over malt vinegar or pyroligneous acid in close vessels, the evaporation of the acid being induced and sustained by the heat of a steam-bath or other appliances.

2694. **Test for White Lead.** Commercial carbonate of lead is never quite pure, being commonly adulterated with sulphate of baryta, (heavy spar), and sometimes with chalk. The former may be detected by its insolubility in dilute nitric acid, and the latter by the nitric solution yielding a white precipitate with oxalic or sulphuric acid, or oxalate of ammonia, after having been treated with sulphuretted hydrogen, or a hydrosulphuret, to throw down the lead. (*Cooley.*)

2695. **Simple Test for White Lead.** Take a piece of firm, close-grained charcoal, and, near one end of it, scoop out a cavity about ½ inch in diameter and ¼ inch in depth. Place in the cavity a sample of the lead to be tested, about the size of a small pea, and apply to it continuously the blue or hottest part of the flame of a blow-pipe; if the sample be strictly pure, it will in a very short time, say in 2 minutes, be reduced to metallic lead, leaving no residue; but if adulterated to the extent of 10 per cent. only with oxide of zinc, sulphate of baryta, whiting or any other carbonate of lime (which substances are now the only adulterations used), or if it be composed entirely of these materials, as is sometimes the case with cheap lead, it cannot be reduced, but will remain on the charcoal an infusible mass. It is well, after blowing upon the sample, say for ½ a minute, by which time the oil will be burned off, to loosen the sample from the charcoal with a knife blade or spatula, in order that the flame may pass under as well as over and against it. With proper care the lead will run into one button, instead of scattering over the charcoal, and this is the reason why the cavity above mentioned is necessary. A common stearine candle or a lard oil lamp furnishes the best flame for use of the blowpipe; the flame of a coal oil lamp should not be used.

2696. **Zinc White** (oxide of zinc) is a permanent pigment; is not affected by sulphuretted hydrogen; does not form soap with oils and fats, therefore it retains its opacity; does not decompose other pigments, and if used with proper vehicles retains its whiteness. It is the best and safest white that can be used. It is most durable in silicious painting, as it forms chemical compounds with potash and silica.

2697. **Sulphate of Baryta,** called barytes and constant white, is very permanent, of a bluish tint; has no body in oil, but is a good white in fresco, silicious, and water-color painting. Chemically it has no action on other colors, and is not itself affected by any ordinary destructive agent. It is a natural product, called *heavy spar.*

2698. **Pfundheller's Method of Obtaining Barytes White.** For each 100 pounds of wool, 3 pounds alum, 1 pound cream of tartar, and 2 pounds sulphuric acid are to be combined with ½ ounce of soluble iodine violet, and the wool immersed in the solution at a temperature of 122° Fahr., and stirred round for an hour at this temperature. Another bath is to be made in the meantime, in a fresh kettle, with 3 pounds chloride of barium, and the whole immersed in this, and kept at a temperature of 122° Fahr., for two hours. By this process the sulphate of barytes, the most beautiful of whites, will be thrown down in the fibre of the wool, which has been saturated in the first bath with the sulphuric acid, and it will gain about eighteen per cent. in weight.

2699. **Cremnitz White,** a beautiful white, with less body than ordinary white lead; it is, doubtless, made by precipitation; it, like ordinary white lead, decomposes sulphides, and is decomposed by sulphuretted hydrogen.

2700. **Cadmium Yellow, Red, etc.** These are sulphides of cadmium, and, when well prepared, are very stable; they can be used in fresco and silicious painting. It is mentioned elsewhere that cadmium sulphide decomposes emerald green. (*See No.* 2712.) It is not safe to use it with lead pigments, unless it has been most carefully prepared; and here, inasmuch as decomposition may take place, and lead sulphide, which is black, be formed, it is better to avoid the mixture; no such mixture can occur in fresco or silicious painting, and it would be well if there were no chance of its occurring in any other style of painting, by the banishment of white lead from the list of artists' pigments. No other salts of cadmium are important as pigments.

2701. **Green Oxide of Chromium.** This oxide is perfectly stable, and, as so many tints of it can be obtained, including the beautiful vividian, it can be used in all vehicles, and is perfectly permanent in fresco and silicious painting. Other chromium compounds are used in painting; the chromates of lead have already been treated of. Chromate of barytes is a good, safe pigment; it is used under the name of lemon yellow. It is permanent in fresco and silicious painting. The chromates generally are unstable colors, and, as there are so many other good yellows, they should not be used as pigments.

2702. **The Ochres** are earths colored by oxide of iron. The natural color of these earths is yellow, but by burning they get darker, and some become red. Indian red, red ochre, light red, etc., are all earths with more or less of the oxide of iron in them. All the ochres are permanent and stable if they have been well prepared. They may be used safely in every style of painting.

2703. **Colcothar** is also an oxide of iron; it is very permanent, and generally useful as a pigment. It can be obtained of different tints. It is, however, especially useful in fresco and silicious painting.

2704. **Venetian Red,** as now prepared, is an iron red; but, whether from adulteration or not, it contains lime; and, as it is made from the sulphate of iron, sulphate of lime gets formed, and this prevents its employment in silicious painting, for with silicate of potash a silicate of lime is immediately formed, and it becomes hard and lumpy. It may be used in oil, water, and fresco.

2705. Chrome Yellow. To a solution of bichromate of potash add a solution of nitrate of lead as long as a precipitate forms. Wash the precipitate, and dry it with a gentle heat. An inferior kind is said to be made by 4 pounds pure white lead, 1 pound bichromate of potash, and 20 pounds water, and boiling till the water becomes colorless. Or 75 parts of precipitated sulphate of lead may be acted on by 25 parts of a hot solution of neutral chromate of potash. A mixed product of chromate and sulphate of lead is thus obtained, which is said to cover as well as the pure chrome, and is much cheaper. (*Riot.*)

2706. Chrome Red. Melt saltpetre in a crucible heated to dull redness, and add chrome yellow, by small portions, till no more red fumes arise. Allow the mixture to settle, then pour off the melted salt from the heavy sediment, and wash the latter with water, which should be quickly poured off, and dry the pigment. The liquefied salt poured off contains chromate of potash, and is reserved for making chrome yellow.

2707. Orange Chrome is chrome yellow acted on by an alkali, which deprives it of part of the chromic acid. All the chromes are chromates of lead, and are therefore liable to be blackened by sulphuretted hydrogen. When used with oil, they may, with care, retain their color for a long time, the oxidized oil protecting them from the action of sulphuretted hydrogen. They cannot be used in silicious, fresco, or any other method of water painting. They are destroyed by alkalies; they should never be used with Prussian blue or kindred colors. On the whole, it would be as well for artists to reject them, as better and safer pigments can be employed for the same purpose as they are.

2708. Aureolin Yellow. An excellent pigment in every respect. It is a double nitrate of potassium and cobalt. It is not acted upon by lime or by potash; it is, therefore, a good pigment for fresco and silicious painting. It may be used with safety in oil and in water. Sulphuretted hydrogen does not affect it, and it is permanent when submitted to the severest tests. It is not affected by admixture with other colors.

2709. Naples Yellow. Mix 12 parts metallic antimony, 8 parts red lead, and 4 oxide of zinc, and calcine in a reverberatory furnace. The mixed oxides are rubbed together, fused, and the fused mass elutriated into a fine powder. (*Dr. Ure.*) *M. Guimel* recommends 1 part well-washed antimoniate of potash to be ground into a paste with 2 parts red lead, and the powder exposed to a red heat for 4 or 5 hours, keeping the heat moderate. This is a good pigment, and may safely be used with oil.

2710. Brunswick Green. Pour a saturated solution of muriate of ammonia over copper filings in a close vessel placed in a warm situation; add more of the solution from time to time till 3 parts of the muriate have been used to 2 of copper. After standing for a few weeks the pigment is separated from the unoxidized copper by washing through a sieve. It is then to be well washed, and dried slowly in the shade. It is often reduced with white lead; some samples contain arsenic.

2711. Mineral Green, Scheele's Green, or Arsenite of Copper. Dissolve 11 ounces white arsenic and 2 pounds carbonate of potash, by heat, in a gallon of water. Dissolve also 2 pounds sulphate of copper in 3 gallons water. Filter each solution separately, and add the former gradually to the latter as long as it occasions a precipitate. Wash the precipitate, drain it, and dry it.

2712. Emerald Green. Mix 10 parts pure verdigris with sufficient boiling water to form a soft pulp, and strain this through a sieve. Dissolve 9 or 10 parts white arsenic in 100 parts boiling water, and, whilst boiling, let the verdigris pulp be gradually added, constantly stirring the mixture till the precipitate becomes a heavy granular powder. It is, on the whole, a permanent color. It should not be used with cadmium yellow, as that is a sulphide, and with it forms sulphide of copper, which is brown. It is a good oil pigment when properly used; it has but little body. It answers well in water-color painting; it cannot, however, be used in fresco or silicious painting.

2713. Green without Arsenic. Dissolve 48 pounds sulphate of copper and 2 pounds bichromate of potash in water, and add to the clear solution 2 pounds pearlash and 1 pound chalk.

2714. Rinmann's Green Pigment. Dissolve together in sufficient water 1 part sulphate of cobalt and 3 sulphate of zinc; precipitate with carbonate of soda, wash the precipitate, and calcine it. It is a permanent color.

2715. Chrome Green. A mixture of chrome yellow and Prussian blue. (*See No.* 2707.)

2716. Black for Miniature Painters. Take camphor, and set it on fire, and collect the soot by means of a saucer or paper funnel inverted over it. This black, mixed with gum-arabic, is far superior to most India-ink.

2717. To Make Lampblack. This can be prepared on a small scale in the following manner: Suspend over a lamp a conical funnel of tin plate, having above it a pipe to convey from the apartment the smoke which escapes from the lamp. Large mushroom-like concretions of a very black carbonaceous matter, and exceedingly light, will be formed at the summit of the cone, and must be collected from time to time. This black may be rendered less oily and drier by calcination in close vessels. The funnel should be united to the pipe, which conveys off the smoke, by means of wire, because solder would be melted by the flame of the lamp.

2718. Indian Red, or Crocus. This is made from jeweler's rouge, by subjecting the scarlet calcined sesquioxide of iron to a further calcination at a very intense heat. It is then known as purple brown.

2719. Ivory-Black. Burn shavings and waste pieces of ivory in a covered crucible, till no more smoke issues. Cover it closely while cooling. It should be afterwards washed with diluted muriatic acid, then with water till no longer acid, dried, and again heated in a covered crucible. It is of a deeper color than bone-black, and is used as a pigment, a tooth powder, and to decolorize syrups and other liquids.

2720. To Make Purple of Cassius. This is a vitrifiable pigment, which stains glass and porcelain a beautiful red or purple hue. Its preparation is one of great nicety, and is liable to fail even in the most experienced hands. Mix together separate solutions of 1 part crystallized protochloride of tin, and 2 parts crystallized perchloride of tin; this mixture, added to a solution of 1 part crystallized chloride of gold, makes a beautiful purple colored precipitate, which should immediately be washed, filtered, and dried. An excess of the protochloride produces a blue, yellow, or greenish tinge; the perchloride in excess gives a red or violet cast.

2721. French Purple of Cassius. This is similar in preparation to the last receipt, but differs in one ingredient employed, substituting perchloride of iron for the perchloride of tin. This purple keeps in the air unaltered for a long time.

2722. Purple of Cassius. To a moderately dilute solution of sesquichloride of iron, add a solution of protochloride of tin, until the mixture becomes green, and dilute the mixture with an equal bulk of water. Next prepare a solution of terchloride of gold, as neutral as possible, in the proportion of 1 part gold in 360 parts water; then add the tin solution, with constant stirring, as long as any precipitate is produced. Wash the precipitate as quickly as possible by decantation, and dry at a gentle heat.

2723. Buisson's Preparation of Purple of Cassius. Two solutions of tin are required. The *first* consists of a neutral solution of 1 part tin in nitric acid. The *second* is made by dissolving 2 parts tin in a mixture of 1 part hydrochloric acid with 3 parts nitric acid; a little heat may be cautiously applied towards the end of this process, to prevent any protoxide of tin from remaining in the solution.

Next dissolve 7 parts gold in an aqua-regia composed of 6 parts hydrochloric acid and 1 part nitric acid; and mix the solution at once with 3500 parts water; then add the whole of the *second* tin solution, subsequently adding by degrees the *first* tin solution, ceasing the moment the right color is obtained. Too little will produce a violet color; too much, a brown. Wash the precipitate very quickly, and dry. When dry it appears brown.

2724. Improved Vehicles for Colors. One measure of saturated solution of borax, with 4 of linseed oil. The pigment may be ground with the oil or the mixture. Or, a solution of shellac with borax, as in making Coathupe's ink. (*See No.* 2484.)

2725. Improved Vehicles for Water Colors. Water colors, mixed with gelatine, and afterwards fixed by washing with a solution of alum, or; curd of milk, washed and pressed, then dried on fine net, and when required for use, mixed with water and the coloring matter.

Drying Oils and Dryers.

All the fixed oils have an attraction more or less powerful for oxygen; and, by exposure to the air, they either become hard and resinous or sour and rancid. Those which exhibit the first property in a marked degree, as the oils of linseed, poppy, rape, and walnut, are called *drying* oils, and are used as vehicles for colors in painting. The drying property of oils is greatly increased by boiling them, either alone or with litharge, sugar of lead, etc., when the product forms the *boiled oil* or *drying oil* of commerce. The litharge and sulphate of lead employed for this purpose, may be again used, after washing them in hot water, to remove adhering mucilage. When paints are mixed with raw oil, as is frequently the case in house painting, the drying quality is obtained by the addition of compositions called *dryers*. These are generally made from Japan varnish, sugar of lead, litharge, etc., and are necessary in such paints as are preferably prepared without boiled oil.

2727. Dark Colored Boiled Oil. Simmer with frequent stirring, 1 gallon of linseed oil, with ¾ pound powdered litharge, until a skin begins to form; then remove the scum, and when it has become cold and has settled, decant the clear portions. This is for house painters' use.

2728. Pale Boiled Oil. Boil 1 quart linseed oil, and 2 ounces powdered white vitriol (sulphate of zinc), with 1 quart water, until the water has all evaporated; settle and decant as in the last receipt.

2729. Very Pale Drying Oil. Mix 2 ounces finely powdered litharge, or dry sulphate of lead, with 1 pint pale linseed or nut oil; agitate frequently for 10 days, then set the bottle in the sun or in a warm place to settle. When clear, decant it.

2730. Colorless Drying Oil for Paint. Take 5 gallons water, heat it to the boiling point in a vessel holding 15 gallons; when about to boil add 5 gallons linseed oil and 1 pound red lead. Keep it constantly boiling and stirred up for 2 hours over a slow fire. If not constantly stirred the lead will sink to the bottom and cause the oil to spatter. It is then taken from the fire and left to settle, when it will be found that the oil is clear and colorless.

2731. Mulder's Colorless Drying Oil. Boil linseed oil for two hours with 3 per cent. of red lead; filter it, and expose it to the sunshine in large shallow vessels, with a glass covering, frequently removing the cover to renew the air.

2732. To Make Boiled Oil Clear and Bright. There is often a difficulty in obtaining the oils *bright* after boiling or heating them with the lead solutions. The best way on a small scale is either to filter the boiled oil through coarse woolen filtering paper, or to expose it in a bottle for some time to the sun or in a warm place. In larger quantities, the oil may be filtered through Canton flannel bags.

2733. Artists' Drying Oil. Mix nut or pale linseed oil with about an equal measure of snow or powdered ice, and keep it for 2 months at a freezing temperature.

2734. Boiled Oil Specially Adapted for Zinc Paint. Mix 1 part binoxide of manganese, in coarse powder, but not dusty, with 10 parts nut or linseed oil; keep it gently heated and frequently stirred for about 30 hours, or until the oil begins to turn reddish. The oil thus prepared will also answer for any paint.

2735. New Drying Oil without Boiling. Mix with old linseed oil (the older the better), 2 per cent. of its weight of manganese borate (this salt is readily prepared by precipitating a solution of sulphate of manganese with a solution of borax, wash the precipitate, and dry it either at the ordinary temperature of the air or at 100°), and heat this mixture on a water-bath; or, if you have to work with large quantities, with a steam-bath to 100°, or at most 110°; you thus obtain a very excellent, light-colored, rapidly drying oil; by keeping the mixture stirred, that is to say, by always exposing fresh portions to air, the drying property of the oil is greatly promoted. The rapidity of the drying of the oil after it has been mixed with paint, on surfaces besmeared therewith, does not simply depend upon the drying property of the oil, but, in a very great measure, upon the state of the atmosphere—viz., whether dry or moist, hot or cold—the direct action of sunlight, and the state of the surfaces on which the paint is brought. Really genuine boiled linseed oil, if well prepared, leaves nothing to be desired as regards rapidity of drying, but it is retarded by various substances which are added in practice, among which, especially, oil of turpentine is injurious.

2736. Dryers for Dark-Colored Paints. This is prepared by grinding the best litharge to a paste with drying oil. A small portion is beaten up with the paint, when mixing with oil and turpentine for use.

2737. Dryers for Light-Colored Paints. Sulphate of zinc, or sugar of lead, mixed with drying oil, and used in the same way as the litharge in the last receipt.

2738. Dryers for White Paint. Mix 1 pound each sulphate of zinc and sugar of lead, with 2 pounds pure white (carbonate of) lead, and apply as in the last receipts.

2739. Patent Dryer. Mix the following ingredients to a paste with linseed oil: 15 pounds dry sulphate of zinc, 4 pounds sugar of lead, and 7 pounds litharge. The mixture should be passed 3 or 4 times through a paint mill. When a tin of this is in use, the surface should be always smoothed down level, and kept covered with a thin layer of linseed oil.

2740. Dryer for Zinc White. Mix together thoroughly 10 parts each sulphate of manganese, acetate of manganese, and sulphate of zinc, with 14¾ parts zinc white. An addition of 2 or 3 per cent. of this dryer to zinc white oil paint will make it dry hard.

2741. To Make Japan Dryer. Into 1 gallon linseed oil, put ¾ pound gum shellac; ½ pound each litharge, burned umber, and red lead; and 6 ounces sugar of lead. Boil together for 4 hours, or until all the ingredients are dissolved. Remove from the fire and add 1 gallon spirits of turpentine.

2742. Cheap Japan Dryer. Mix together 4 gallons pure linseed oil; 4 pounds each litharge and red lead; and 2 pounds powdered raw umber. Boil slowly for 2 hours, add by degrees 7½ pounds shellac, and boil ½ hour longer; when well mixed, add by degrees 1 pound powdered sulphate of zinc, and when nearly cold mix in thoroughly 7 gallons spirits of turpentine.

2743. To Make Paint Dry Quickly. To make paint dry quickly use a large proportion of Japan varnish in mixing.

2744. Massicot. Yellow protoxide of lead. The dross that forms on melted lead exposed to a current of air, roasted until it acquires a uniform yellow color. Used as a pigment, and in glazing. (*Cooley*).

House Painting.

The following directions are obtained from a thoroughly practical source, and will be found useful both to the amateur and the workman.

2746. Priming. The same paint is used for the first coat in outside and inside work; it should be as thick as will work conveniently, and requires only litharge for dryers. The paint should not be laid on too thickly, and well worked in with the brush.

2747. Priming for Iron Work. This must be oil color laid on a surface freed from rust. For paper and canvas, a coat of size takes the place of priming, as paint rots these materials.

2748. Puttying. This consists in filling up all nail-heads and cracks with putty, by a putty knife; and should always be done after priming.

2749. Second Coat for Outside Work. Mix the paint with raw oil, as thick as it can be used freely. Cover the surface, work it across to even it, and finish longways with long, light sweeps of the brush.

2750. Third Coat for Outside Work. The paint should be mixed with oil, a little thinner than for the second coat; laid on very evenly, and not too thickly, and finished as smooth as possible.

2751. Second Coat for Inside Work. The paint for this coat should be mixed with raw oil and turpentine, about equal parts, and be as thick as will work freely; laid on thinly and well crossed and finished to prepare a smooth surface, with as few ridges as possible, for the next coat.

2752. Third Coat for Inside Work. Mix the paint thinner than for the last coat, using but little oil, and more turpentine; laid on thinly and well finished, so as to leave no brush marks.

2753. Fourth Coat or Flatting for Inside Work. The paint is mixed with turpentine only, and thin enough to spread or flow even, before it sets; lay on evenly and quickly, brushing lengthways only, and finishing up as the work proceeds, as this paint sets quickly, and spots touched up afterwards are apt to be glossy.

2754. Drawn Flatting for a Fourth Coat. The oil in which the white lead or other paint is ground, is drawn out by mixing with turpentine, allowing the paint to settle, and then pouring off the liquid; repeating the operation with fresh turpentine till the oil has been completely washed out. This makes a better color, without gloss, and easily flowing. As it sets very quickly it must be applied thickly, evenly, and quickly, with closed doors and windows, to avoid a draught.

2755. When to Apply Paint. Paint, to last long, should be put on early in winter or spring, when it is cold and no dust flying. Paint put on in cold weather forms a body or coat upon the surface of the wood that becomes hard and resists weather, or an edged tool even, like slate.

2756. General Directions for House Painting. Oil paint dries with a gloss, turpentine makes a dead surface; and, in using paints containing both oil and turpentine, the gloss will be less as the proportion of oil is diminished. Paint requires more dryer in cold than in hot weather, but is more durable in outside work if applied in cold weather. Successive coats of paint should have at least a day intervene between them for drying. Dark colors should have a glossy finish. Before commencing to paint, the surface must be perfectly dry. The paint must be thoroughly mixed, both before commencing and during the progress of the work; if this is neglected, the heavy ingredients are apt to settle, leaving a larger proportion of oil and turpentine on the surface.

2757. Painter's Size. Stir a small quantity of litharge and red lead into some boiled oil; let it stand, shaking frequently until bleached; then bottle. Raw oil makes a slower drying size.

2758. Best Painter's Size. Heat raw oil in a pan till it emits a black smoke; set it on fire, and, after burning for a few minutes, cover the pan over to put out the blaze; pour the oil while warm into a bottle in which some pulverized red lead and litharge have been introduced. Stand the bottle in a warm place for two weeks, shaking often. It will then be ready to decant and bottle.

2759. To Paint Zinc. A difficulty is often experienced in causing oil colors to adhere to sheet zinc. Boettger recommends the employment of a mordant, so to speak, of the following composition: 1 part chloride of copper, 1 of nitrate of copper, and 1 of sal-ammoniac are to be dissolved in 64 parts of water, to which solution is to be added 1 part of commercial hydrochloric acid. The sheets of zinc are to be brushed over with this liquid, which gives them a deep black color; in the course of from 12 to 24 hours they become dry, and to their now dirty gray surface a coat of any oil color will firmly adhere. Some sheets of zinc prepared in this way, and afterwards painted, have been found to withstand all the changes of winter and summer.

2760. Polish White. This is made by grinding dry zinc-white with white varnish, and affords a beautiful glossy finish, to be laid on after the second coat. A more perfect surface may be obtained by covering the second coat with several other coats of hard drying paint, mixed with turpentine, Japan and litharge; then rubbing down with pumice-stone, followed by a coat of polish white, and finished with a flow coat of white varnish containing a little zinc-white. Although this requires more time and trouble, the result will fully compensate for it. It is necessary to remark that when the last coat is to be glossy, the previous coat must be flat or dead; and a flat coat for finishing should be preceded by a somewhat glossy coat.

2761. To Mix Oil Colors. In mixing different colored paints to produce any desired tint, it is best to have the principal ingredient thick, and add to it the other paints thinner. In the following table of the combinations of colors required to produce a required tint, the first named color is the principal ingredient, and the others follow in the order of their importance. Thus, in mixing a limestone tint, white is the principal ingredient, and red the color of which least is needed, &c. The exact proportions of each depending on the shade of color required.

2762. Table of Compound Colors, Showing the Simple Colors which Produce them.

Buff	White, Yellow Ochre, Red
Chestnut	Red, Black, Yellow
Chocolate	Raw Umber, Red, Black
Claret	Red, Umber, Black
Copper	Red, Yellow, Black
Dove	White, Vermilion, Blue, Yellow
Drab	White, Yellow Ochre, Red, Black
Fawn	White, Yellow, Red
Flesh	White, Yellow Ochre, Vermilion
Freestone	Red, Black, Yellow Ochre, White
French Gray	White, Prussian Blue, Lake
Gray	White Lead, Black
Gold	White, Stone Ochre, Red
Green Bronze	Chrome Green, Black, Yellow
Do Pea	White, Chrome Green
Lemon	White, Chrome Yellow
Limestone	White, Yellow Ochre, Black, Red
Olive	Yellow, Blue, Black, White
Orange	Yellow, Red
Peach	White, Vermilion
Pearl	White, Black, Blue
Pink	White, Vermilion, Lake
Purple	Violet, with more Red and White
Rose	White, Madder Lake
Sandstone	White, Yellow Ochre, Black, Red
Snuff	Yellow, Vandyke Brown
Violet	Red, Blue, White. (*See No.* 2761.)

2763. To Prepare Whitewashed Walls for Painting. If there should be any cracks in the plastering, and the wash be sound around the cracks, plaster of Paris is the best thing to fill them with, as it hardens quickly, does not shrink, and leaves the surface level with the wall. If the plaster of Paris sets before it can be worked, wet it with vinegar. The stronger the acid, the slower it will set. If cracks be filled with putty, and the wall be painted in gloss color, the streaks of putty are very apt to be flat (no gloss), and if painted in flat color, the streaks are quite sure to have a gloss. These streaks, of course, will spoil the beauty of the work, but do not affect its durability. When filled with plaster of Paris the reversion of gloss never appears, if done as directed below. If the cracks be only in the wash, the latter is loosening from the wall; and if it has not begun to scale, it soon will, and all attempts to fasten it on and paint it will be total loss. If it be loose enough to scrape off, scrape the wall, taking care not to gouge into the original wall. If not loose enough, let it alone until it is. If the wash be thin, solid, and even, it can be painted to look and wear well. When the surface is lumpy, rub the lumps off with a sandstone, or a brick. After a wall has been prepared, as in either of above cases, or if a wall that has never been washed is to be painted, size it with 2 coats of glue size (3 ounces glue to 1 gallon water). (*See No.* 2815.) Be sure the glue is all dissolved before using any of it. Let the first coat dry before the second coat is put on.

2764. To Paint Whitewashed Walls. When the second coat of glue size (*see No.* 2763) is dry, paint as follows: Mix the first coat of paint in the proportion of 1 gallon raw linseed oil to 15 pounds white lead, ground in oil, and 1 gill of dryer. Second coat: 1 gallon raw linseed oil, 25 pounds white lead ground in oil, and ½ gill dryer. (The lead should be the best.) Then finish either in gloss or flat color, the same as if it were wood work with one good coat of priming. Shade all the coats of paint, as near as you can, to the color you wish to finish in. Mix the third and fourth coats the same as the first, that is, about the same thickness for a gloss finish, and a little thinner for a flat finish.

2765. Flexible Paint for Canvas. Dissolve 2¼ pounds good yellow soap, cut in slices, in 1½ gallons boiling water; grind the solution while hot with 140 pounds good oil paint.

2766. Durable Black Paint for Out-Door Work. Grind powdered charcoal in linseed oil, with sufficient litharge as drier; thin for use with well-boiled linseed oil.

2767. Green Paint for Out-Door Work. Add to the black paint, made according to the last receipt, sufficient yellow ochre to make the shade of green required. This is preferable for garden work, to the bright green paint generally used, as it does not fade.

2768. Paint for Iron Work. There is no production for iron work so efficacious as well boiled linseed oil, properly laid on. The iron should be first well cleaned and freed from all rust and dirt; the oil should be of the best quality, and well boiled, without litharge or any dryer being added. The iron should be painted over with this, but the oil must be laid on as bare as possible, and on this fact depends in a great measure the success of the application; for if there be too thick a coat of oil put upon the work, it will skin over, be liable to blister, and scarcely ever get hard; but if iron be painted with three coats of oil, and only so much put on each coat as can be made to cover it by hard brushing, we will guarantee that the same will preserve the iron from the atmosphere for a much longer time than any other process of painting. If a dark coloring matter be necessary, we prefer burnt umber to any other pigment as a stain; it is a good hard dryer, and has many other good properties, and mixes well with the oil without injuring it.

2769. Painting in Milk. In consequence of the injury which has often resulted to sick and weakly persons from the smell of common paint, the following method of painting with milk has been adopted by some workmen, which, for the interior of buildings, besides being as free as distemper from any offensive odor, is said to be nearly equal to oil-painting in body and durability. Take ½ gallon skimmed milk, 6 ounces lime newly slacked, 4 ounces poppy, linseed, or nut oil, and 3 pounds Spanish white. Put the lime into an earthen vessel or clean bucket, and having poured on it a sufficient quantity of milk to make it about the thickness of cream, add the oil in small quantities at a time, stirring the mixture with a wooden spatula. Then put in the rest of the milk, and afterwards the Spanish white. It is, in general, indifferent which of the oils above mentioned you use; but, for pure white, oil of poppy is the best. The oil in this composition, being dissolved by the lime, wholly disappears; and, uniting with the whole of the other ingredients, forms a kind of calcareous soap. In putting in the Spanish white, be careful that it is finely powdered and strewed gently over the surface of the mixture. It then, by degrees, imbibes the liquid and sinks to the bottom. Milk skimmed in summer is often found to be curdled; but this is of no consequence in the present preparation, as its combining with the lime soon restores it to its fluid state. But it must on no account be sour; because in that case it would, by uniting with the lime, form an earthy salt, which could not resist any degree of dampness in the air.

2770. To Make Paint without Oil or Lead. Whiting, 5 pounds; skimmed milk, 2 quarts; fresh slacked lime, 2 ounces. Put the lime into a stone-ware vessel, pour upon it a sufficient quantity of the milk to make a mixture resembling cream; the balance of the milk is then to be added; and lastly the whiting is to be crumbled upon the surface of the fluid, in which it gradually sinks. At this period it must be well stirred in, or ground as you would other paint, and it is fit for use. There may be added any coloring matter that suits the fancy, to be applied in the same manner as other paints, and in a few hours it will become perfectly dry. Another coat may then be added, and so on until the work is done. This paint is of great tenacity, bears rubbing with a coarse cloth, has little smell, even when wet, and when dry is inodorous. It also possesses the merit of cheapness, the above quantity being sufficient for 57 yards.

2771. Paint for Old Weather-Boarding, or Boat Bottoms. Take 5 gallons boiled linseed oil, 4 gallons raw oil, 1 gallon benzine, and 80 pounds Rocky Mountain vermilion.

2772. Fireproof Paint. Take a quantity of the best quicklime, and slack with water in a covered vessel; when the slacking is complete, water or skim milk, or a mixture of both, should be added to the lime, and mixed up to the consistency of cream; then there must be added, at the rate of 20 pounds alum, 15 pounds potash, and 1 bushel salt to every 100 gallons of creamy liquor. If the paint is required to be white, 6 pounds plaster of Paris, or the same quantity of fine white clay, is to be added to the above proportions of the other ingredients. All these ingredients being mingled, the mixture must then be strained through a fine sieve, and afterwards ground in a color mill. When roofs are to be covered, or when crumbling brick walls are to be coated, fine white sand is mixed with the paint, in the proportion of 1 pound sand to 10 gallons of paint; this addition being made with a view of giving the ingredients a binding or petrifying quality. This paint should always be applied in a hot state, and in very cold weather precautions are necessary to keep it from freezing. Three coats of this paint are deemed, in most cases, sufficient. Any color may be obtained by adding the usual pigments to the composition.

2773. To Paint an Old House. Take 3 gallons water and 1 pint flax seed; boil ½ hour; take it off and add water enough to make 4 gallons; let it stand to settle; pour off the water in a pail, and put in enough of Spanish white to make it as thick as whitewash; then add ½ pint linseed oil; stir it well and apply with a brush. If the whiting does not mix readily, add more water. Flax seed, having the nature of oil, is better than glue, and will not wash off as readily.

2774. Paint for Boilers. The best paint for boilers is asphaltum dissolved in spirits of turpentine over a gentle fire. Pulverize the asphaltum and dissolve as much as will be taken up by the turpentine. If pure it will last.

2775. To Reduce Paint Skins to Oil. Dissolve ½ pound sal-soda in 1 gallon rain water. The skins that dry upon the top of paint which has been left standing for any length of time, may be made fit for use again by covering them with the sal-soda water and soaking them therein for a couple of days; then heat them, adding oil to reduce the mixture to a proper consistence for painting, and strain.

2776. To Remove the Smell of New Paint. Hay sprinkled with a little chloride of lime, and left for an hour in a closed room, will remove the smell of new paint.

2777. To Kill Knots before Painting. A mixture of glue size and red lead; or shellac dissolved in alcohol and mixed with red lead; or gutta-percha dissolved in ether; will, either of them, make a good coating for knots, but will not stand the sunshine, which will draw the pitch through the paint. The best method is to cover the knot with oil size, and lay a leaf of silver over it.

2778. To Kill Grease Spots Before Painting. Wash over smoky or greasy parts with saltpetre, or very thin lime whitewash. If soap-suds are used, they must be washed off thoroughly, as they prevent the paint from drying hard.

2779. To Make a Sticky Painted Surface Hard. Rub it well in, with a brush, with Japan and turpentine mixed together.

2780. To Prepare Plastered Walls for Painting. Plastered and hard finished walls must have a coating of glue size before painting. (*See No.* 2815.)

2781. To Economize Paint. Save all the skins, cleanings and scrapings of the paint pots, and wipings out of the brushes; these, boiled up in oil, make a cheap and durable coating for outside work. (*See No.* 2775.)

2782. To Remove Smalt from Old Signs. Spread over it, potash dissolved in water, and then scrape the smalt off. If the potash stands too long before scraping, it may soak into the wood; and paint afterwards put on will not dry well.

2783. To Remove Putty from Glass. Dip a small brush in nitric or muriatic acid, and with it paint over the dry putty that adheres to the broken glasses and frames of the windows. After an hour's interval the putty will have become so soft as to be easily removable.

2784. To Soften Putty in Window Frames. To soften putty in window frames, so that the glass may be taken out without breakage or cutting, take 1 pound American pearlash, 3 pounds quick stone lime, slack the lime in water, then add the pearlash, and make the whole about the consistence of paint. Apply it to both sides of the glass, and let it remain for 12 hours, when the putty will be so softened that the glass may be taken out of the frame without being cut, and with the greatest facility. (*See No.* 2786.)

2785. To Remove Hard Putty. This may be effected with a paste of caustic potassa, prepared by mixing the caustic alkali, or even carbonate of potash or soda, with equal parts of freshly burnt quicklime, which has previously been sprinkled with water, so as to cause it to fall into powder. This mixture is then made with water to a paste, and spread on the putty to be softened. Where one application is not sufficient, it is repeated. In order to prevent the paste from drying too quickly, it is well to mix it with less water, adding some soft-soap.

2786. For Removing Old Putty. For removing hard putty from a window-sash, take a square piece of iron, make the same red-hot, and run it along the putty till it gets soft. The putty will peel off without injuring the wood-work. Concentrated lye made of lime and alkali will affect the wood and make it rot quicker. (*See No.* 2784.)

2787. To Remove Paint from Old Work. To destroy paint on old doors, etc., lay the mixture in receipt No. 2784 over the whole body of the work which is required to be cleaned, with an old brush (as it will spoil a new one); let it remain for 12 or 14 hours, when the paint can be easily scraped off. These two receipts have been used by a practical painter and glazier for years.

2788. To Remove Paint from Wood. Where it is necessary to remove paint entirely, this is generally done by scraping; another way is to soften the paint by passing a flat flame over a portion of the surface at a time, and it can be scraped off easily while hot; but the method most recommended is to lay on a thick coating or plaster of fresh slacked lime mixed with soda; next day, wash it off with water, and it will remove the paint, leaving the surface clean.

2789. To Remove Paint from Stone. A correspondent of the London Builder, having to clean a pulpit and sedilia in which the carving and tracery were almost filled up with successive coats of paint, was informed that common washing-soda, dissolved in boiling water, and applied hot, would remove it. He found that 3 pounds of soda to a gallon of water, laid on with a common paint-brush, answered the purpose admirably, softening the paint in a short time, so that it was easily removed with a stiff scrubbing-brush; afterward, on adding a few ounces of potash to the solution, it softened more readily than with soda only. The stone in both cases was a fine freestone.

2790. To Soften Hard Putty. Break the putty in lumps of the size of a hen's egg, add a small portion of linseed oil, and water sufficient to cover the putty; boil this in an iron vessel for about 10 minutes, and stir it when hot. The oil will mix with the putty. Then pour the water off, and it will be like fresh made.

2791. To Clean Old Paint Cans, Buckets, etc. This can be thoroughly done with hot, strong lye.

2792. To Pencil or Point Brick Work. The upright as well as the horizontal lines should be drawn with a straight edge, as the least want of uniformity spoils the appearance of the brick work. White lead mixed with turpentine, and thick enough to set firm, is the best for this purpose.

Kalsomine and Whitewash.

The following receipts include the methods of preparing and applying white and other coatings on walls, etc., as well as the preparatory treatment of the surface to which they are to be applied, and other useful information.

2794. To Prepare Kalsomine. Kalsomine is composed of zinc white mixed with water and glue sizing. The surface to which it is applied must be clean and smooth. For ceilings, mix ½ pound glue with 15 pounds zinc; for walls, 1 pound glue with 15 pounds zinc. The glue, the night before its use, should be soaked in water, and in the morning liquefied on the fire. It is difficult to prepare or apply kalsomine; few painters can do so successfully. Paris white is often made use of for it, but it is not the genuine article. (*See next receipt.*) The kalsomining mixture may be colored to almost any required tint by mixing appropriate coloring matter with it.

2795. To Kalsomine Walls. In case the wall of a large room, say 16 by 20 feet square, is to be kalsomined with two coats, it will require about ¼ pound light-colored glue and 5 or 6 pounds Paris white. (*See last receipt.*) Soak the glue over night, in a tin vessel containing about a quart of warm water. If the kalsomine is to be applied the next day, add a pint more of clean water to the glue, and set the tin vessel containing the glue into a kettle of boiling water over the fire, and continue to stir the glue until it is well dissolved and quite thin. If the glue pail be placed in a kettle of boiling water, the glue will not be scorched. Then, after putting the Paris white into a large water pail, pour on hot water, and stir it until the liquid appears like thick milk. Now mingle the glue liquid with the whiting, stir it thoroughly, and apply it to the wall with a whitewash-brush, or with a large paint-brush. It is of little consequence what kind of an instrument is employed in laying on the kalsomine, provided the liquid is spread smoothly. Expensive brushes, made expressly for kalsomining, may be obtained at brush factories, and at some drug and hardware stores. But a good whitewash-brush, having long and thick hair, will do very well. In case the liquid is so thick that it will not flow from the brush so as to make smooth work, add a little more hot water. When applying the kalsomine, stir it frequently. Dip the brush often, and only so deep in the liquid as to take as much as the hair will retain without letting large drops fall to the floor If too much glue be added, the kalsomine cannot be laid on smoothly, and will be liable to crack. The aim should be to apply a thin layer of sizing that cannot be brushed off with a broom or dry cloth. A thin coat will not crack.

2796. Whitewash for Out-Door Use. Take a clean water-tight barrel, or other suitable cask, and put into it ½ bushel lime. Slack it by pouring boiling water over it, and in sufficient quantity to cover 5 inches deep, stirring it briskly till thoroughly slacked. When slacking has been effected, dissolve in water and add 2 pounds sulphate of zinc and 1 of common salt. These will cause the wash to harden and prevent it from cracking, which gives an unseemly appearance to the work. If desirable, a beautiful cream color may be communicated to the above wash, by adding 3 pounds yellow ochre. This wash may be applied with a common whitewash-brush, and will be found much superior, both in appearance and durability, to common whitewash.

2797. Treasury Department Whitewash. This receipt for whitewashing, sent out by the Lighthouse Board of the Treasury Department, has been found, by experience, to answer on wood, brick and stone, nearly as well as oil paint, and is much cheaper. Slack ½ bushel unslacked lime with boiling water, keeping it covered during the process. Strain it, and add a peck of salt, dissolved in warm water; 3 pounds ground rice put in boiling water, and boiled to a thin paste; ½ pound powdered Spanish whiting, and a pound of clear glue, dissolved in warm water; mix these well together, and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace, and, when used, put it on as hot as possible, with painters' or whitewash-brushes.

2798. To Color Whitewash. Coloring matter may be put in and made of any shade. Spanish brown stirred in will make red pink, more or less deep according to the quantity. A delicate tinge of this is very pretty for inside walls. Finely pulverized common clay, well mixed with Spanish brown, make a reddish stone color. Yellow ochre stirred in makes yellow wash, but chrome goes further, and makes a color generally esteemed prettier. In all these cases the darkness of the shades of course is determined by the quantity of coloring used. It is difficult to make rules, because tastes are different; it would be best to try experiments on a shingle and let it dry. Green must not be mixed with lime. The lime destroys the color, and the color has an effect on the whitewash, which makes it crack and peel. When walls have been badly smoked, and you wish to have them a clean white, it is well to squeeze indigo plentifully through a bag into the water you use, before it is stirred in the whole mixture.

2799. Zinc Whitewash. Mix oxide of zinc with common size, and apply it with a whitewash-brush to the ceiling. After this, apply in the same manner a wash of chloride of zinc, which will combine with the oxide to form a smooth cement with a shining surface.

2800. A Fine Whitewash for Walls. Soak ¼ pound of glue over night in tepid water. The next day put it into a tin vessel with a quart of water, set the vessel in a kettle of water over a fire, keep it there till it boils, and then stir until the glue is dissolved. Next put from 6 to 8 pounds Paris white into another vessel, add hot water, and stir until it has the appearance of milk of lime. Add the sizing, stir well, and apply in the ordinary way, while still warm. Except on very dark and smoky walls and ceilings, a single coat is sufficient. It is nearly equal in brilliancy to zinc-white (a far more expensive article), and is very highly recommended by those who have used it. Paris white is sulphate of baryta, and may be found at any drug or paint store.

2801. **Fire-Proof Whitewash.** Make ordinary whitewash and add 1 part silicate of soda (or potash) to every 5 parts of the whitewash. (*See No.* 2816.)

2802. **Whitewash for Outside Work.** Take of good quicklime ½ a bushel, slack in the usual manner and add 1 pound common salt, ½ pound sulphate of zinc (white vitriol), and 1 gallon sweet milk. The salt and the white vitriol should be dissolved before they are added, when the whole should be thoroughly mixed with sufficient water to give the proper consistency. The sooner the mixture is then applied the better.

2803. **Whitewash for Fences or Out-Buildings.** Slack the lime in boiling water, and to 3 gallons ordinary whitewash add 1 pint molasses and 1 pint table salt. Stir the mxiture frequently while putting it on. Two thin coats are sufficient.

2804. **To Mix Whitewash.** Pour boiling water on unslacked lime, and stir it occasionally while it is slacking, as it will make the paste smoother. To 1 peck of lime add ½ pint of salt and ½ ounce of indigo dissolved in water, or the same quantity of Prussian blue finely powdered; add water to make it the proper thickness to put on a wall.

2805. **To Keep Whitewash.** Keep the lime covered with water and in a tub which has a cover, to prevent dust or dirt from falling in. If the water evaporates the lime is useless, but if kept covered it will be good as long as any remains.

2806. **To Whiten Smoked Walls.** A method of cleaning and whitening smoked walls consists, in the first place, of rubbing off all the black, loose dirt upon them, by means of a broom, and then washing them down with a strong soda lye, which is to be afterward removed by means of water to which a little hydrochloric acid has been added. When the walls are dry a thin coating of lime, with the addition of a solution of alum, is to be applied. After this has become perfectly dry the walls are to be kalsomined or coated with a solution of glue and chalk.

2807. **To Color, and Prevent Whitewash Rubbing Off.** Alum is one of the best additions to make whitewash of lime which will not rub off. When powdered chalk is used glue water is also good, but would not do for outside work exposed to much rain. Nothing is easier than to give it any desired color by small quantities of lampblack, brown sienna, ochre, or other coloring material.

2808. **To Paper Whitewashed Walls.** The following method is simple, sure, and inexpensive: Make flour starch as you would for starching calico clothes, and, with a whitewash-brush, wet the wall you wish to paper, with the starch; let it dry; then, when you wish to apply the paper, wet the wall and paper both with the starch, and apply the paper. Walls have been papered in this way that have been whitewashed 10 or even 20 years successively, and the paper has never failed to stick. When you wish to re-paper the wall, with the brush wet the paper with clear water, and it will come off readily. (*See No.* 2811.)

2809. **Red Wash for Bricks.** To remove the green that gathers on bricks, pour over the bricks boiling water in which any vegetables (not greasy) have been boiled. Do this for a few days successively, and the green will disappear. For the red wash melt 1 ounce of glue in a gallon of water; while hot, put in a piece of alum the size of an egg, ½ pound Venetian red, and 1 pound Spanish brown. Try a little on the bricks, let it dry, and if too light add more red and brown; if too dark, put in more water. This receipt was contributed by a person who has used it for 20 years with perfect success.

Paper Hanging.

In cities, this is either a trade by itself, or is carried on as an adjunct to the painter's trade. In rural districts, however, there are many housekeepers who do this work for themselves. The following receipts are given for the guidance of housekeepers.

2811. **To Prepare a Wall for Papering.** A new unwhitewashed wall will absorb the paste so rapidly that, before drying, there will be left too little body of paste on the surface to hold the paper. A coating of good glue size, made by dissolving ½ pound of glue in a gallon of water (*see No.* 2815), or a coating of good paste, put on and allowed to dry before the paper is hung, will provide for this difficulty. If the wall be whitewashed, it should be scratched with a stiff brush, to remove every particle of loose lime from the surface; after which it should be thoroughly swept down with a broom, and coated with the glue size or thin paste. (*See No.* 2808.)

2812. **Utensils for Paper Hanging.** A long table of thin boards cleated together and placed on wooden horses, such as are used by carpenters, a pair of sharp shears—with long blades, if possible—a whitewash-brush, a pail for paste, and a yard of cotton cloth, are the implements required. The table or board platform should be level on its upper surface to facilitate the distribution of the paste. The latter should be free from lumps, and should be laid on as evenly as possible. It should be made of good sweet rye or wheat flour, beaten smooth in cold water before boiling, and should not be allowed to boil more than a minute or two, but should be raised to the boiling point slowly, being continually stirred till it is taken from the fire. (*See No.* 2272.)

2813. **To Prepare Paper for Hanging.** Inexpert hands often find difficulty in hanging the lengths of paper so as to make the patterns match. No general directions can be given for this, but a little study at the outset will often save cutting to waste, and other difficulties. In this matter, as in others, it is wise to "first be sure you are right, then go ahead." As soon as the proper way to cut the paper is decided upon, a whole roll, or more, may be cut at once, and the pieces laid, printed side downwards, upon the table, weights being placed upon the ends to prevent curling. The paste should then be applied to the back of the uppermost piece, as expeditiously as possible, as the longer the time employed in this part of the operation, the more tender will the paper get, and the more difficult it will be to hang it properly. About one-quarter of the length should be turned up at the bottom of the strip before hanging; as, without this, the bottom is apt to stick to the wall before the upper part of the strip can be adjusted. If the paper is very thick, both ends must be folded over, so as to meet in the middle. Besides being more convenient for handling, this allows the paper to soften, without the paste getting dry.

2814. To Apply Paper to Walls. The upper end of the piece should then be taken by the corners, and the operator, stepping upon a bench or step-ladder, should barely stick the piece at the top, and in such a manner that the edge shall coincide with the piece previously hung; this can be done by sighting down the trimmed edge of the piece, while it is held in the hands. The cloth should now be held in a loose bunch, and the paper smoothed with it from top to bottom, care being taken to work out all air from under the paper, which, if not thoroughly done, will give it a very unsightly blistered appearance. If any air remains under a part of the strip after it has been hung, a hole must be pricked through the paper with a pin, to allow of its escape. A *soft* flat whisk-brush (such as is used for brushing clothes) is better for smoothing the paper than a cloth. After the top is secured so that the pattern matches, brush once down the centre of the strip as far as the paste is exposed. Then carefully unfold the bottom of the strip, brush down the centre, and smooth the whole by brushing from the centre to the edges, right and left, all the way down, finishing with one sweep down the trimmed edge, to ensure a perfect join. A moist cloth should be always at hand to keep the figures clean and free from color. If the wall be uneven or crooked, as is often the case in old houses, it will be difficult to avoid wrinkles, but they can be mostly got rid of by cutting the paper and allowing the cut edges to lap over each other, in places where there would otherwise be a wrinkle. By following these directions the most inexperienced will be able to do a reasonably tidy piece of work, but of course a high degree of skill is only secured by practice.

2815. To Make Glue Sizing. Break up the glue into small pieces, put it in a vessel with sufficient cold water to just cover it; let it soak over night, and in the morning the glue will be soft enough to melt readily with a moderate heat, or in a water-bath. Add water to reduce to the desired consistency. This must be applied as directed in the foregoing receipts.

Soluble Glass.

This is a combination of silica with an alkali, soluble in boiling water, yielding a fine, transparent, semi-elastic varnish. When made according to Liemen's or Kuhlman's method, under increased pressure and heat, it is unaffected by cold water, and the object painted or covered by the same can only be deprived of its coating by undergoing the same heat and pressure as was required to prepare the original solution. Soluble glass prepared from potash is usually called *silicate of potash;* that from soda being *silicate of soda.* The most extensive use which is made, at present, of soluble glass produced after the other methods, is for the adulteration of soap; in fact, such a preparation is a kind of soap, in which the expensive fatty acids are replaced by the cheap silicic acid or sand; but it is a bad soap, very caustic, as the silicic acid but very imperfectly neutralizes the alkali. Another use of water glass is that of hardening cements, mortar, etc., so as to render them impermeable by water.

2817. Fuchs' Soluble Potash Glass. A mixture of 15 parts pulverized quartz, or pure quartz sand, 10 parts of well purified potash, and 1 part powdered charcoal, may be conveniently employed. These ingredients are to be well mixed and exposed to a strong heat in a fire-proof melting-pot for 5 or 6 hours, until the whole fuses uniformly and steadily; as much heat is required as is necessary to melt common glass. The melted mass is then taken out by means of an iron spoon, and the melting-pot immediately refilled with a fresh quantity. (At this stage of the process it is said by another authority, that, by pulverizing and exposing it to the air, it will absorb acidity, and by degrees the foreign salts will, after frequent agitation and stirring, be completely separated, particularly after pouring over the mass some cold water, which dissolves them, but not the soluble glass.) It is then broken up, pulverized, and dissolved in about 5 parts of boiling water, by introducing it in small portions into an iron vessel and constantly stirring the liquid, replacing the water as it evaporates, by adding hot water from time to time, and continuing to boil for 3 or 4 hours, until the whole is dissolved—a slimy deposit excepted—and until a pellicle begins to form on the surface of the liquid, which indicates that the solution is in a state of great concentration; it disappears, however, when the liquid is stirred; and the boiling may then be continued for a short time, in order to obtain the solution in the proper state of concentration, when it has a specific gravity of from 1.24 to 1.25 (about 28° Baumé). In this state it is sufficiently liquid to be used in many operations; in some instances it will be necessary to dilute it with more or less water. When evaporated to a syrupy consistence, it can be employed with advantage in but few cases. Very frequently it is found contaminated with a little sulphide of potassium, and it becomes necessary to add a little oxide of copper or copper scales towards the end of the boiling, which liberates a small quantity of potash, but which renders it rather more suitable for many practical purposes than otherwise. If it is desirable, however, to have a water-glass which is entirely neutral, it requires to be boiled with freshly-precipitated silica as long as any silica is dissolved.

2818. Fuchs' Soluble Soda Glass. This is prepared in the same way as the potash glass (*see No.* 2817), with the exception that a smaller proportion of soda is required. A mixture of 45 parts by weight of quartz, 23 parts dry carbonate of soda, and 3 parts charcoal, may be employed. The mixture fuses somewhat easier than potash glass.

2819. Buchner's Soluble Soda Glass. Take 100 parts quartz, 60 parts dry sulphate of soda, and 15 to 20 parts charcoal. This is said to be cheaper than that made with carbonate of soda, and is prepared in the same manner. By the addition of some copper scales to the mixture the sulphur will be separated. Another method is proposed by dissolving the fine silex in caustic soda lye. Kuhlman employs the powdered flint, which is dissolved in an iron caldron under a pressure of 7 to 8 atmospheres of steam. Liebig has recommended infusorial earth in place of sand, on account of its being readily soluble in caustic lye; and he proposes to use 120 parts of the earth to 75 parts of caustic soda, from which 240 parts of silica jelly may be obtained. His mode is to calcine the earth so as to become white, and passing it through a sieve. The lye he prepares from 75 ounces of calcined soda, dissolved in 5 times the quantity of boiling water, and then treated by 56 ounces of dry slacked lime; this lye is concentrated by boiling down to 48° Baumé; in this boiling lye 120 ounces of the prepared infusorial earth are added by degrees, which are readily dissolved, leaving scarcely any sediment. It has then to undergo several operations for making it suitable for use, such as treating again with lime-water, boiling it and separating any precipitate, which by continued boiling forms into balls, and which can then be removed from the liquid. This clear liquid is then evaporated to the consistency of syrup; it forms a jelly slightly colored, feels dry and not sticky, and is readily soluble in boiling water. The difference between potash and soda soluble glass is not material; the first may be preferred in whitewashing with plaster of Paris, while the soda glass is more fluidly divisible.

2820. To Distinguish Potash and Soda Soluble Glass. By adding ¼ volume of rectified alcohol to a concentrated solution of soluble potash glass, a gelatinous precipitate is formed, which, in a few days, is deposited at the bottom of the vessel in a solid mass. The addition of alcohol to soluble soda glass converts it into a gelatinous mass, but affords no precipitate.

2821. To Make Wood Incombustible. The application of soluble glass to wood renders it almost incombustible.

2822. Double Soluble Glass. A mixture of 3 parts by measure of concentrated potash soluble glass, and 2 parts concentrated soda glass, produce a double water-glass which will answer all practical purposes.

The following preparation is also recommended by Fuchs, as being much easier to fuse. Take 100 parts quartz, 28 parts purified potash, 22 parts neutral dry carbonate of soda, and 6 parts powdered charcoal.

2823. Soluble Glass for Stereo-Chromic Painting. Soluble glass for the use of stereo-chromic painting is obtained by fusing 3 parts of pure carbonate of soda and 2 parts of powdered quartz, from which a concentrated solution is prepared, 1 part of which is then added to 4 parts of a concentrated and fully saturated solution of potash-glass solution, by which there is a more condensed amount of silica with the alkalies; this solution has been found to work well for paint. Siemens' patent for the manufacture of soluble glass consists in the production of a liquid quartz by digesting the sand or quartz in a steam-boiler tightly closed and at a temperature corresponding to 4 or 5 atmospheres, with the common caustic alkalies, which are in this way capacitated to dissolve from 3 to 4 times the weight of silica to a thin liquid. Experience has taught that the soluble glass made in the old way, with an excess of alkali, cannot stand the influence of the atmosphere when used as a paint. The soda washes out, and leaves the silex in a pulverized condition, so that it soon disappears. When, however, a closed boiler is used, according to Kuhlman's or Siemens' method, and a pressure of 7 or 8 atmospheres, which corresponds with a temperature of some 120° above the boiling point of water, the solvent qualities of the latter are increased to such an extent as to enable it to dissolve a glass containing ⅓ to ½ the amount of potash or soda.

To Dye Wood. Dyeing wood is mostly applied for giving color to veneers, while staining is more generally had recourse to, to give the desired color to an article after it has been manufactured. In the one case, the color should penetrate throughout, while in the latter the surface is all that is essential. After the veneers are cut, they should be allowed to lie in a trough of water for 4 or 5 days before being put into the copper; as the water brings out abundance of slimy matter, which, if not thus removed, would prevent the wood taking a good color. After this purifying process, the veneers should be dried in the open air for at least 12 hours. They are then ready for the copper. By this simple method, the color will strike much quicker, and be of a brighter hue. It would also add to the quality of the colors, if, after the veneers have boiled a few hours, they are taken out, dried in the air, and again immersed in the coloring copper. Always dry veneers in the open air, for fire invariably injures the colors. (*See Nos.* 2837, *etc.*)

2825. Fine Black Dye for Wood. Put 6 pounds chip logwood into the copper, with as many veneers as it will conveniently hold, without pressing too tight; fill it with water, and let it boil slowly for about 3 hours; then add ½ pound powdered verdigris, ½ pound copperas, and 4 ounces bruised nut-galls; fill the copper up with vinegar as the water evaporates; let it boil gently 2 hours each day till the wood is dyed through.

2826. Fine Yellow Dye for Wood. Reduce 4 pounds of barberry root by sawing, to dust, which put in a copper or brass trough;

add 4 ounces turmeric and 4 gallons water, then put in as many white holly veneers as the liquor will cover; boil them together for 3 hours, often turning them; when cool, add 2 ounces aquafortis, and the dye will strike through much sooner.

2827. Bright Yellow Dye for Wood. To every gallon of water necessary to cover the veneers, add 1 pound French berries; boil the veneers till the color has penetrated through; add some brightening liquid (*see next receipt*) to the infusion of the French berries, and let the veneers remain for 2 or 3 hours, and the color will be very bright.

2828. Liquid For Brightening and Setting Colors. To every pint of strong aquafortis, add 1 ounce grain tin, and a piece of sal-ammoniac the size of a walnut; set it by to dissolve, shake the bottle round with the cork out, from time to time: in the course of 2 or 3 days it will be fit for use. This will be found an admirable liquid to add to any color, as it not only brightens it, but renders it less likely to fade from exposure to the air.

2829. Fine Blue Dye for Wood. Into a clean glass bottle put 1 pound oil of vitriol, and 4 ounces best indigo pounded in a mortar (take care to set the bottle in a basin or earthen glazed pan, as it will effervesce), put the veneers into a copper or stone trough; fill it rather more than ⅓ with water, and add as much of the vitriol and indigo (stirring it about) as will make a fine blue, which you may know by trying it with a piece of white paper or wood; let the veneers remain till the dye has struck through. The color will be much improved if the solution of indigo in vitriol be kept a few weeks before using it. The color will also strike better if the veneers be boiled in plain water till completely soaked through, and left for a few hours to dry partially, previous to immersing them in the dye.

2830. Bright Green Dye for Wood. Proceed as in either of the previous receipts to produce a yellow; but instead of adding aquafortis or the brightening liquid, add as much vitriolated indigo (*see last receipt*) as will produce the desired color.

2831. Bright Red Dye for Wood. To 2 pounds genuine Brazil dust, add 4 gallons water; put in as many veneers as the liquor will cover; boil them for 3 hours; then add 2 ounces alum, and 2 ounces aquafortis, and keep it lukewarm until it has struck through.

2832. Red Dye for Wood. To every pound of logwood chips, add 2 gallons water; put in the veneers, and boil as in the last; then add a sufficient quantity of the brightening liquid (*see No.* 2828), till the color is of a satisfactory tint; keep the whole as warm as you can bear your finger in it, till the color has sufficiently penetrated. The logwood chips should be picked from all foreign substances with which it generally abounds, as bark, dirt, &c.; and it is always best when fresh cut, which may be known by its appearing of a bright red color; for if stale, it will look brown, and not yield so much coloring matter.

2833. Rose Colored Dye for Wood. Monier produces a fine pink or rose-color on wood of cellulose, especially that of the ivory nut, by immersing it first in a solution of iodide of potassium, 1¼ ounces per pint of water, in which it remains for several hours, when it is placed in a bath of corrosive sublimate, 135 grains to the pint. When properly dyed it is washed and varnished over. We should think that less poisonous materials might be found to answer the same purpose.

2834. Bright Purple Dye for Wood. Boil 2 pounds logwood, either in chips or powder, in 4 gallons water, with the veneers; after boiling till the color is well struck in, add by degrees vitriolated indigo (*see No.* 2829), till the purple is of the shade required, which may be known by trying it with a piece of paper; let it then boil for 1 hour, and keep the liquid in a milk-warm state till the color has penetrated the veneer. This method, when properly managed, will produce a brilliant purple.

2835. Orange Dye for Wood. Let the veneers be dyed by either of the methods given for a fine deep yellow (*see Nos.* 2826 *and* 2827), and while they are still wet and saturated with the dye, transfer them to the bright red dye (*see No.* 2821), till the color penetrates equally throughout.

2836. Silver-Gray Dye for Wood. Expose any quantity of old iron, or, what is better, the borings of gun-barrels, &c., in any convenient vessel, and from time to time sprinkle them with muriatic acid, diluted in 4 times its quantity of water, till they are very thickly covered with rust; then to every 6 pounds add 1 gallon of water in which has been dissolved 2 ounces salt of tartar (carbonate of potassa); lay the veneers in the copper, and cover them with this liquid; let it boil for 2 or 3 hours till well soaked, then to every gallon of liquor add ¼ pound of green copperas, and keep the whole at a moderate temperature till the dye has sufficiently penetrated.

2837. To Dye Veneers. Some manufacturers of Germany, who had been supplied from Paris with veneers, colored throughout their mass, were necessitated by the late war to produce them themselves. Mr. Puscher states that experiments made in this direction gave in the beginning colors fixed only on the outside, while the inside was untouched, until the veneers were soaked for 24 hours in a solution of caustic soda containing 10 per cent. of soda, and boiled therein for ½ hour; after washing them with sufficient water to remove the alkali, they may be dyed throughout their mass. This treatment with soda effects a general disintegration of the wood, whereby it becomes, in the moist state, elastic and leather-like, and ready to absorb the color; it must then, after dyeing, be dried between sheets of paper and subjected to pressure to retain its shape.

2838. To Dye Veneers Black. Veneers treated as in last receipt and left for 24 hours in a hot decoction of logwood (1 part logwood to 3 water), removing them after the lapse of that time, and, after drying them superficially, putting them into a hot solution of copperas (1 part copperas to 30 water), will, after 24 hours, become beautifully and completely dyed black.

2839. To Dye Veneers Yellow. A solution of 1 part picric acid in 60 water, with the addition of so much ammonia as to become perceptible to the smell, dyes veneers yellow, which color is not in the least affected by subsequent varnishing. Before dyeing, the veneers require the preparatory treatment given in No. 2837.

2840. To Dye Veneers Rose-Color. Coralline dissolved in hot water, to which a little caustic soda and one-fifth of its volume of soluble glass has been added, produces rose-colors of different shades, dependent on the amount of coralline taken. (*See No.* 2837.)

2841. To Dye Veneers Silver-Gray. The only color which veneers will take up, without previous treatment of soda, is silver-gray, produced by soaking them for a day in a solution of 1 part copperas to 100 parts water.

To Stain Wood.

Staining wood is altogether a different process from dyeing it, and requires no preparation before the stain be applied. In preparing the stain, but little trouble is required; and, generally speaking, its application differs very little from that of painting. When carefully done, and properly varnished, staining has a very beautiful appearance, and is much less likely to meet with injury than japanning.

2843. Black Stain for Immediate Use. Boil ½ pound chip logwood in 2 quarts water, add 1 ounce pearlash, and apply it hot to the work with a brush. Then take ½ pound logwood, boil it as before in 2 quarts water, and add ½ ounce verdigris and ½ ounce green copperas; strain it off, put in ½ pound rusty steel filings; with this, go over the work a second time.

2844. To Stain Wood Like Ebony. Take a solution of sulphate of iron (green copperas), and wash the wood over with it 2 or 3 times; let it dry, and apply 2 or 3 coats of a strong hot decoction of logwood; wipe the wood, when dry, with a sponge and water, and polish with linseed oil.

2845. To Stain Wood Light Mahogany Color. Brush over the surface with diluted nitrous acid, and when dry apply the following, with a soft brush: dragon's blood, 4 ounces; common soda, 1 ounce; spirit of wine, 3 pints. Let it stand in a warm place, shake it frequently, and then strain. Repeat the application until the proper color is obtained.

2846. To Stain Dark Mahogany Color. Boil ½ pound madder and 2 ounces logwood in 1 gallon water; then brush the wood well over with the hot liquid. When dry, go over the whole with a solution of 2 drachms pearlash in 1 quart water.

2847. To Stain Mahogany Color. Pure Socotrine aloes, 1 ounce; dragon's blood, ½ ounce; rectified spirit, 1 pint; dissolve, and apply 2 or 3 coats to the surface of the wood; finish off with wax or oil tinged with alkanet. Or: Wash over the wood with strong aquafortis, and when dry, apply a coat of the above varnish; polish as last. Or: Logwood, 2 ounces; madder, 8 ounces; fustic, 1 ounce; water, 1 gallon; boil 2 hours, and apply it several times to the wood boiling hot; when dry, slightly brush it over with a solution of pearlash, 1 ounce, in water, 1 quart; dry and polish as before. Or: Logwood, 1 part; water, 8 parts. Make a decoction and apply it to the wood; when dry, give it 2 or 3 coats of the following varnish: dragon's blood, 1 part; spirits of wine, 20 parts. Mix.

2848. Beechwood Mahogany. Dissolve 2 ounces dragon's blood and 1 ounce aloes in 1 quart rectified spirit of wine, and apply it to the surface of the wood previously well polished. Or: Wash over the surface of the wood with aquafortis, and when thoroughly dry give it a coat of the above varnish. Or: Boil 1 pound logwood chips in 2 quarts water, and add 2 handfuls of walnut peel; boil again, then strain, and add 1 pint good vinegar; apply as above.

2849. Artificial Mahogany. The following method of giving any species of wood of a close grain the appearance of mahogany in texture, density, and polish, is said to be practiced in France with success. The surface is planed smooth, and the wood is then rubbed with a solution of nitrous acid; 1 ounce dragon's blood is dissolved in nearly a pint of spirits of wine; this, and ⅛ ounce carbonate of soda, are then to be mixed together and filtered, and the liquid in this thin state is to be laid on with a soft brush. This process is to be repeated, and in a short interval afterwards the wood possesses the external appearance of mahogany. When the polish diminishes in brilliancy, it may be restored by the use of a little cold-drawn linseed oil.

2850. Fine Black Stain. Boil 1 pound logwood in 4 quarts water, add a double handful of walnut-peel or shells; boil it up again, take out the chips, add 1 pint best vinegar, and it will be fit for use; apply it boiling hot. This will be improved by applying a hot solution of green copperas dissolved in water (an ounce to a quart), over the first stain.

2851. To Imitate Rosewood. Boil ½ pound logwood in 3 pints water till it is of a very dark red; add ½ ounce salt of tartar (carbonate of potassa). While boiling hot, stain the wood with 2 or 3 coats, taking care that it is nearly dry between each; then, with a stiff flat brush, such as is used by the painters for graining, form streaks with the black stain above named (*see last receipt*), which, if carefully executed, will be very nearly the appearance of dark rosewood; or, the black streaks may be put in with a camel's hair pencil, dipped in a solution of copperas and verdigris in a decoction of logwood. A handy brush for the purpose may be made out of a flat brush, such as is used for varnishing; cut the sharp points off, and make the edges irregular, by cutting out a few hairs here and there, and you will have a tool which will accurately imitate the grain.

2852. To Imitate Rosewood. Stain with the black stain (*see No.* 2850); and when dry, with a brush dipped in the brightening liquid (*see No.* 2828), form red veins, in imitation of the grain of rosewood, which will produce a beautiful effect.

2853. New Stain for Wood. Permanganate of potassa is recommended as a rapid and excellent stain for wood. A solution of it spread upon pear or cherry wood, for a few minutes, leaves a permanent dark brown color, which, after careful washing, drying, and oiling, assumes a reddish tint upon being polished.

2854. Stolzel's Method of Staining Wood Brown. Dr. Stolzel adds another to the many receipts already given for staining wood of a brown color. First of all paint over the wood with a solution made by boiling 1 part of catechu (Cutch or Gambier) with 30 parts water and a little soda. This is allowed to dry in the air, and the wood is then painted over with another solution made of 1 part bichromate of potash and 30 parts water. By a little difference in the mode of treatment, and by varying the strength of the solutions, various shades of color may be given with these materials, which will be permanent and tend to preserve the wood.

2855. To Darken Light Mahogany. When furniture is repaired, it frequently happens that the old wood cannot be matched, and therefore the work presents a patched appearance. To prevent this, wash the pieces introduced, with soap-lees, or dissolve quicklime in water, and use in the same manner; but be careful not to let either be too strong, or it will make the wood too dark; it is best, therefore, to use it rather weak at first, and, if not dark enough, repeat the process till the wood is sufficiently darkened.

2856. Red Stain for Bedsteads and Common Chairs. Archil will produce a very good stain of itself, when used cold; but if, after 1 or 2 coats being applied and suffered to get almost dry, it is brushed over with a hot solution of pearlash in water, it will improve the color.

2857. To Improve the Color of any Stain. Mix in a bottle 1 ounce of nitric acid, ½ tea-spoonful muriatic acid, ¼ ounce grain tin, and 2 ounces rain water. Mix it at least 2 days before using, and keep the bottle well corked.

2858. To Stain Musical Instruments and Fancy Boxes. Fancy work necessitates the employment of brighter colors than those used for furniture; we therefore give the following receipts for preparing and applying those most commonly employed for such purposes.

2859. Fine Crimson Stain. Boil 1 pound good Brazil dust in 3 quarts water for an hour; strain it, and add ½ ounce cochineal; boil it again gently for ½ an hour, and it will be fit for use. If required of a more scarlet tint, boil ½ ounce saffron in 1 quart of water for an hour, and pass over the work previous to the red stain.

2860. Fine Green Stain. To 3 pints strongest vinegar, add 4 ounces best verdigris pounded fine, ¼ ounce sap green, and ¼ ounce indigo. Distilled vinegar, or verjuice, improves the color.

2861. Purple Stain. To 1 pound good chip logwood, put 3 quarts water; boil it well for an hour; then add 4 ounces pearlash, and 2 ounces pounded indigo.

2862. Fine Blue Stain. Into 1 pound oil of vitriol (sulphuric acid) in a clean glass phial, put 4 ounces indigo, and proceed as above directed in dyeing purple.

2863. Bright Yellow Stain. Wood need not be stained yellow, as a small piece of aloes put into the varnish will have the desired effect.

2864. Fine Black Stain. As a general thing, when black is required in musical instruments, it is produced by japanning; the work being well prepared with size and lampblack, apply the black japan (*see No.* 2322), after which, varnish and polish. But as a black stain is sometimes required for fingerboards, bridges, and flutes, proceed as directed in staining (*see No.* 2850); the wood, however, ought to be either pear, apple, or boxwood; the latter is preferable; and if it be rubbed over, when dry, with a rag or flannel dipped in hot oil, it will give it a gloss equal to ebony.

2865. To Stain Boxwood Brown. Hold the work to the fire, that it may receive a gentle warmth; then take aquafortis, and with a feather pass over the work until it changes to a fine brown (always keeping it near the fire); then oil and polish it.

2866. Cane Staining. By the following simple process, canes and similar sticks may be stained a rich brown: Dissolve a few grains sulphate of manganese in sufficient water to take it up; moisten the surface of the cane with it, and hold it over the flame of a spirit lamp close enough to scorch it. By care, the whole surface may be brought to a uniform rich brown, or beautifully variegated by heating some parts more than others; thus varying the color from white to the deepest black. The color will appear dull at first; but, on oiling it with raw linseed oil, and rubbing it with a smooth piece of hard wood, it will be beautifully developed. Give the cane no other finish, unless it be another oiling some days after the first.

Varnish.

Varnishes may be conveniently divided into two kinds, viz., spirit and oil varnishes. Concentrated alcohol is used as the solvent in the former, and fixed or volatile oils, or mixtures of the two, for the latter. The specific gravity of alcohol for the purpose of making varnishes should not be greater than 0.820 (that is, not below about 93 per cent). Camphor is often dissolved in it to increase its solvent powers. The oil of turpentine, which is the essential oil chiefly employed, should be pure and colorless. Pale drying linseed oil is the fixed oil generally used for varnishes, but poppy and nut oil are also occasionally employed. Among the substances employed in the manufacture of varnishes are turpentine, copal, mastich, lac, elemi, sandarach, anime, and amber, to impart body and lustre; benzoin to impart scent; gamboge, turmeric, saffron, annotto, and Socotrine aloes, to give a yellow color; dragon's blood to give a red tinge; asphaltum to give a black color and body; caoutchouc to impart body, toughness, and elasticity. Varnish constitutes a distinct branch of manufacture, and many of them can be advantageously or safely made only on the large scale on premises adapted for the purpose.

2868. Preparation of Linseed Oil for Making Oil Varnishes. In the manufacture of oil varnishes, one of the most important points is the use of good drying oil. Linseed oil for this purpose should be pale, limpid, brilliant, scarcely odorous, and mellow and sweet to the taste. 100 gallons of such oil are put into an iron or copper boiler capable of holding 150 gallons, and gradually heated to a gentle simmer for 2 hours, to expel moisture; the scum is then carefully removed, and 14 pounds scale litharge, 12 pounds red lead, and 8 pounds powdered umber (all carefully dried and free from moisture), are gradually sprinkled in; the whole is then kept well stirred, to prevent the dryers sinking to the bottom, and the boiling is continued at a gentle heat, for 3 hours longer; the fire is next withdrawn, and, in 24 to 36 hours, the scum is carefully removed, and the clear oil decanted from the bottom. This forms the best boiled or drying oil.

2869. Clarified Oil for Varnish. When boiled oil is used for making varnish, and a still further clarifying is deemed advisable, it is placed in a copper pan holding from 80 to 100 gallons, and heat gradually applied till the scum rises, after removing which the oil is allowed to boil for about 2 hours, when it is dosed with calcined magnesia, in the proportion of an ounce to every 4 gallons of oil, but added by degrees and with occasional stirrings. This being completed, the oil is again boiled briskly for about an hour, and then, the furnace being drawn, allowed to cool. When the temperature is sufficiently reduced, it is removed to leaden cisterns, where it is stored till fit for use.

2870. Clarified Linseed Oil for Varnishes. Heat in a copper boiler 50 gallons of linseed oil to 280° Fahr.; add 2½ pounds of calcined white vitriol, and keep the oil at the above temperature for ½ hour; then remove it from the fire, and in 24 hours decant the clear oil, which should stand for a few weeks before it is used for varnish.

2871. Wilks' Refined Linseed Oil. In 236 gallons oil pour 6 pounds oil of vitriol, and stir them together for 3 hours; then add 6 pounds fullers' earth, well mixed with 14 pounds hot lime, and stir for 3 hours. Put the oil into a copper boiler, with an equal quantity of water, and boil for 3 hours; then extinguish the fire, and when the materials are cold draw off the water, and let the oil stand to settle for a few weeks before using.

2872. Boiled Oil for Varnishes. Mix 100 gallons linseed oil and 7 pounds calcined white vitriol (sulphate of zinc) in fine powder, in a clean copper boiler; heat it to 285° Fahr., and keep it at that temperature for at least an hour, constantly stirring it; then allow it to cool; in 24 hours decant the clear portion, and in 3 or 4 weeks rack it for use.

2873. Cautions Respecting the Making of Varnish. As heat in many cases is necessary to dissolve the gums used in making varnish, the best way, when practicable, is to use a sand-bath, which is simply placing the vessel containing the varnish, in another filled with sand and placed on the fire. This will generally be sufficient to prevent the spirits catching fire; but to avoid such an accident (which not unfrequently happens), it will be best to take a vessel sufficiently large to prevent any danger of spilling its contents; indeed, the vessel should never be more than two-thirds filled. However, a piece of board sufficiently large to cover the top of the vessel should always be at hand in case the spirits should take fire; as also a wet wrapper, in case it should be spilled, as water itself thrown on would only increase the mischief. The person who attends the varnish-pot should have his hands covered with gloves, and, if they are made of leather, and rather damp, it will effectually prevent injury. These cautions should be well observed, or shocking personal injury may result from their neglect. In the city, it is hardly worth while to make varnish, unless in large quantities, as there are many stores where it may be had very good, and at a fair price; but in the country, where the freight is an object, and you cannot depend upon the genuineness of the article, it is necessary to be known by the practical mechanic how to make it; when it is available, it is best to purchase it. The varnish generally sold for varnishing furniture is white hard varnish.

Oil Varnishes.

These, the most durable and lustrous of varnishes, are composed of a mixture of resin, oil, and spirit of turpentine. The oils most frequently employed are linseed and walnut; the resins chiefly used are copal and amber, and some other gums. The drying power of the oil having been increased by litharge, red lead, or by sulphate of lead, and a judicious selection of copal having been made, it is necessary, according to Booth, to bear in mind the following facts before proceeding to the manufacture of varnish: 1. That varnish is not a solution, but an intimate mixture of resin with boiled oil and spirit of turpentine. 2. That the resin must be completely fused previous to the addition of the boiled or prepared oil. 3. That the oil must be heated from 250° to 300°. 4. That the spirit of turpentine must be added gradually, and in a thin stream, while the mixture of oil and resin is still hot. 5. That the varnish be made in dry weather, otherwise moisture is absorbed, and its transparency and drying quality impaired. Of late years it has been practically demonstrated that not only is there no necessity for boiling the oil and gum after incorporation, but that the produce is equally good if the turpentine be added just before the mixture becomes too cold to permit of a perfect amalgamation. In fact, it is now acknowledged that the oil need not be raised to a higher temperature than that at which the gum employed fuses, and that when the two are mixed the lowest possible degree of heat which will insure their incorporation, is sufficient to secure all the results desired. By this method a large quantity of the turpentine formerly lost in evaporation is saved, and there is, moreover, less risk of fire. The heating vessel must be of copper, of a capacity at least one-third more gallons than the mixture to be introduced into it, with a riveted and not a soldered bottom. To promote the admixture of the copal with the hot oil, the copal—carefully selected and of nearly uniform fusibility—is separately heated with continuous stirring over a moderate charcoal fire kept constantly supplied with fuel, without disturbing the kettle until the completion of the mixture with the oil. If the copal is melted in the hot oil, the resulting varnish is more colored and less drying. There is, however, great care required in fusing the copal by itself; for if the heat is too much prolonged, the resin becomes pitchy, and gives an inferior varnish. Constant stirring is requisite to prevent adhesion to the sides and bottom of the vessel, and consequent scorching. The pieces of copal should be of uniform fusibility; the different varieties, therefore, should not be fused together, for that which melts first is apt to scorch before the more refractory are fused. If it is desired to mix different varieties, they should be fused separately and then mixed in fluid state. When the resin is thoroughly melted, the hot oil is to be ladled in gradually during constant stirring. To determine when sufficient oil has been added, a drop must be now and then taken out and cooled upon a glass plate. If, on cooling, it is limpid and wax-like, penetrable with the nail without cracking, the proportion of oil is sufficient; if, however, it is hard and brittle, more oil is required. Some resins absorb more oil than others. The spirits of turpentine should be heated, and added in a thin stream to the oil and resin while still hot. Care must be taken not to add the turpentine while the mixture is too hot, as too much of the turpentine will be lost by evaporation; but if the mixture gets too cool it becomes sticky, the addition of turpentine must be stopped, and it must be replaced over the fire and heated gradually up to 600°. Limpidity is thus restored, and, upon removal from the fire, sufficient turpentine should be added to impart the proper consistence; but this extra heating injures the quality of the varnish.

2875. Common Oil Varnish. Resin, 3 pounds; drying oil, ½ gallon; melt together, and add, when removed from the fire, 2 quarts warm oil of turpentine.

2876. Oil Copal Varnish. Pale hard copal, 2 pounds; fuse, add hot drying oil, 1 pint; boil as before directed, and thin with oil of turpentine, 3 pints, more or less, as found necessary. Very pale. Dries hard in 12 to 24 hours.

2877. Best Pale Carriage Varnish. Pale African copal, 8 pounds; fuse, and add clarified linseed oil, 2½ gallons; boil till very stringy, then add dried copperas and litharge, of each ¼ pound; boil as before directed, thin with oil of turpentine, 5½ gallons; mix while hot with the following varnish, and immediately strain the mixture into a covered vessel: Gum anime, 8 pounds; clarified linseed oil, 2½ gallons; dried sugar of lead and litharge, of each ¼ pound; boil as before, thin with oil of turpentine, 5½ gallons, and mix it while hot with the last varnish as above directed. Dries in 4 hours in summer and 6 in winter. Used for the wheels, springs, and carriage parts of coaches and other vehicles, and by house painters, decorators, &c., who want a strong, quick-drying, and durable varnish.

2878. Ordinary Carriage Varnish. Sorted gum anime, 8 pounds; clarified oil, 3 gallons; litharge, 5 ounces; dried and powdered sugar of lead and white copperas, of each 4 ounces; boil as last, and thin with oil of turpentine, 5½ gallons.

2879. Amber Varnish. Amber, 1 pound; pale boiled oil, 10 ounces; turpentine, 1 pint. Render the amber, placed in an iron pot, semi-liquid by heat; then add the oil, mix, remove it from the fire, and, when cooled a little, stir in the turpentine. Or: To the amber, melted as above, add 2 ounces of shellac, and proceed as before. This varnish is rather dark, but remarkably tough. The first form is the best. It is used for the same purposes as copal varnish, and forms an excellent article for covering wood, or any other substance not of a white or very pale color. It dries well, and is very hard and durable.

2880. Black Amber Varnish. Amber, 1 pound; boiled oil, ½ pint; powdered asphaltum, 6 ounces; oil of turpentine, 1 pint. Melt the amber, as before described, then add the asphaltum, previously mixed with the cold oil, and afterwards heated very hot; mix well, remove the vessel from the fire, and, when cooled a little, add the turpentine, also made warm. Each of the above two varnishes should be reduced to a proper consistence with more turpentine if it be required. The last form produces the beautiful black varnish used by the coachmakers. Some manufacturers omit the whole or part of the asphaltum, and use the same quantity of clear black resin instead, in which case the color is brought up by lampblack reduced to an impalpable powder, or previously ground very fine with a little boiled oil. The varnish made in this way lacks, however, that richness, brilliancy, and depth of blackness imparted by asphaltum.

2881. Pale Amber Varnish. Amber, pale and transparent, 6 pounds; fuse, add hot clarified linseed oil, 2 gallons; boil till it strings strongly, cool a little, and add oil of turpentine, 4 gallons. Pale as copal varnish; soon becomes very hard, and is the most durable of oil varnishes; but requires time before it is fit for polishing. When wanted to dry and harden quicker, drying oil may be substituted for linseed, or dryers may be added during the boiling.

2882. Tough Amber Varnish. Amber, 1 pound; melt, add Scio turpentine, ½ pound; transparent white resin, 2 ounces; hot linseed oil, 1 pint; and afterwards sufficient oil of turpentine as above. Very tough.

2883. Hard Amber Varnish. Melted amber, 4 ounces; hot boiled oil, 1 quart; as before.

2884. Very Pale Amber Varnish. Very pale and transparent amber, 4 ounces; clarified linseed oil and oil of turpentine, of each 1 pint; as before. Amber varnish is suited for all purposes where a very hard and durable oil varnish is required. The paler kind is superior to copal varnish, and is often mixed with the latter to increase its hardness and durability.

2885. Varnish for Waterproof Goods. Let ¼ pound of India-rubber, in small pieces, soften in ½ pound of oil of turpentine, then add 2 pounds boiled oil, and let the whole boil for 2 hours over a slow coal fire. When dissolved, add again 6 pounds boiled linseed oil and 1 pound litharge, and boil until an even liquid is obtained. It is applied warm, and forms a waterproof coating.

2886. India-Rubber Oil Varnish. Take 4 ounces India-rubber in fine shavings, dissolve in a covered jar by means of a sand-bath, in 2 pounds of crude benzole, and then mix with 4 pounds hot linseed oil varnish, and ½ pound oil of turpentine. Dries well.

2887. India-Rubber Oil Varnish. Cut up 1 pound India-rubber into small pieces and diffuse in ½ pound sulphuric ether, which is done by digestion in a glass flask on a sand-bath. Then add 1 pound pale linseed oil varnish, previously heated, and after settling, 1 pound oil of turpentine, also heated beforehand. Filter, while yet warm, into bottles. Dries slowly.

2888. Gutta-Percha Oil Varnish. Clean ¼ pound gutta-percha in warm water from adhering impurities, dry well, dissolve in 1 pound of rectified resin oil, and add 2 pounds linseed oil varnish, boiling hot. Very suitable to prevent metals from oxidation.

2889. Champagnat's India-Rubber Varnish. In a wide-mouthed glass bottle, digest 2 ounces India-rubber in fine shavings, with 1 pound oil of turpentine, during 2 days, without shaking, then stir up with a wooden spatula. Add another pound oil of turpentine, and digest, with frequent agitation, until all is dissolved. Then mix 1½ pounds of this solution with 2 pounds of very white copal oil varnish, and 1½ pounds well boiled linseed oil; shake and digest in a sand-bath, until they have united in a good varnish. For morocco leather.

2890. Flexible Varnish. Melt 1 pound of resin, and add gradually ½ pound India-rubber in very fine shavings, and stir until cold. Then heat again, slowly, add 1 pound linseed oil varnish, heated, and filter.

2891. Flexible Varnish. Dissolve 1 pound of gum damar, and ½ pound India-rubber in very small pieces, in 1 pound oil of turpentine, by means of a water-bath. Add 1 pound hot oil varnish and filter.

2892. Hair Varnish. Dissolve 1 part of clippings of pigs' bristles, or of horse-hair, in 10 parts of drying linseed oil by heat. Fibrous materials (cotton, flax, silk, &c.), imbued with the varnish and dried, are used as a substitute for hair-cloth.

2893. Cabinet Varnish. Fuse 7 pounds African copal, and pour on it 4 pints hot clarified linseed oil; in 3 or 4 minutes, if it feels stringy, take it out of the building, where there is no fire near, and when it has cooled to 150° mix in 3 gallons oil of turpentine of the same temperature, or sufficient to bring it to a due consistence.

2894. Bessemer's Varnish for Metallic Paint. This is made with 8 pounds copal, 2½ gallons drying oil, and 25 gallons oil of turpentine. These are made into a varnish nearly as directed for Cabinet Varnish (*see No.* 2893); and afterwards mixed with a gallon of slacked lime and left for 3 days to settle. The clear portion is then drawn off, and 5 parts of varnish mixed with 4 parts of bronze powder.

2895. Mahogany Varnish. Sorted gum anime, 8 pounds; clarified oil, 3 gallons; litharge and powdered dried sugar of lead, of each ¼ pound; boil till it strings well, then cool a little, thin with oil of turpentine, 5½ gallons, and strain.

2896. Italian Varnish. Boil Scio turpentine till brittle; powder, and dissolve in oil of turpentine. Or: Canada balsam and clear white resin, of each 6 ounces; oil of turpentine, 1 quart, dissolved. Used for prints, engravings, &c.

2897. Varnish for Printers' Ink. To every 10 pounds clarified linseed oil add 5 pounds clear black resin, and ½ pound oil of turpentine. It is then ready for mixing with lampblack or other coloring matter. A twelfth part of Canada balsam is sometimes added for the finer parts.

2898. Varnish for Frames for Hot Beds. Mix 4 ounces pulverized white cheese, 2 ounces slacked lime, and 4 ounces boiled linseed oil. Mix, and add 4 ounces each whites and yolks of eggs, and liquefy the mixture by heat. This curious mixture is said to produce a pliable and transparent varnish.

2899. Brunswick Black. Foreign asphaltum, 45 pounds; drying oil, 6 gallons; and litharge, 6 pounds. Boil for 2 hours, then add dark gum-amber (fused), 8 pounds; hot linseed oil, 2 gallons. Boil for 2 hours longer, or until a little of the mass, when cooled, may be rolled into pills. Then withdraw the heat, and afterwards thin down with 25 gallons oil of turpentine. Used for iron-work, &c.

2900. Black Varnish for Iron-Work. Asphaltum, 48 pounds, fuse; add boiled oil, 10 gallons; red lead and litharge, of each 7 pounds; dried and powdered white copperas, 3 pounds. Boil for 2 hours; then add dark gum amber (fused), 8 pounds; hot linseed oil, 2 gallons; boil for two hours, proceeding as in the last receipt, thinning down with oil of turpentine, 30 gallons. Used for the same purposes as Brunswick black.

2901. Colored Oil Varnishes. Oil varnishes are colored by grinding with them the most transparent colors, as distilled verdigris for green, &c. Spirit varnishes are also colored with dragon's blood, gamboge, &c. (*See No.* 2867.).

2902. Varnish for Grates. To 2 pounds common asphaltum, fused in an iron pot, add 1 pint hot boiled linseed oil; mix well and boil for some time. When partially cooled add 2 quarts oil of turpentine. If too thick, add turpentine. Apply with an ordinary paint brush.

Spirit Varnishes.

The spirit employed for making spirit varnishes should not be less than 95 per cent. In preparing and using them, they should be kept at a distance from a candle or other flame. Respecting the gums (resins) employed, it may be useful to mention that shellac is rendered more soluble by being powdered and exposed for a long time to the air (*see No.* 2906); sandarach gives hardness to varnishes; mastich gives a gloss to a solution of other gums; benzoin still more, but its color is objectionable; anime readily dissolves, but renders the varnish long in drying; copal and amber are scarcely soluble in spirit, but are rendered partially so by other gums, and also by being previously fused by heat. (*See No.* 2867.) Shellac gives a durable varnish, objectionable only on account of its color, which may be rendered paler by charcoal. (*Beasley.*) (*See No.* 1723, *&c.*) In the preparation of spirit varnishes, care should be taken to prevent the evaporation of the alcohol as much as possible, and also to preserve the portion that evaporates. On the small scale, spirit varnishes are best made by maceration in close bottles. In order to prevent the agglutination of the resin, it is often advantageously mixed with clear silicious sand, or pounded glass, by which the surface is much increased, and the solvent power of the menstruum promoted. The tendency of a spirit varnish to chill or give a rough surface may be destroyed by adding to the varnish a little gum sandarach, oil of lavender or concentrated ammonia.

2904. To Dissolve Copal in Spirit. Take the copal and expose it in a vessel formed like a cullender to the front of a fire, and receive the drops of melted gum in a basin of cold water; then dry them well in a temperature of about 95° Fahr. By treating copal in this way it acquires the property of dissolving in alcohol.

2905. Copal Varnish. Take 1 ounce copal and ½ an ounce shellac; powder them well, and put them into a bottle or jar containing 1 quart spirits of wine. Place the mixture in a warm place, and shake it occasionally, until the gums are completely dissolved; and, when strained, the varnish will be fit for use. The above is the simplest, and therefore the most usual method of making common copal varnish; but it may be prepared in a variety of ways, where particular uses may be required.

2906. To Dissolve Gum Shellac. Everybody who has ever to deal with bleached gum shellac knows the difficulties and the loss of time attending its solution. To obviate this, the gum is broken into small pieces and macerated in a stoppered bottle with ether; after swelling up sufficiently, the excess of ether is poured off, when it will dissolve quite readily in alcohol. (*See No.* 2903.)

2907. Copal Varnish. Take 3 ounces copal, melt by a gentle heat, and drop it into water (*see No.* 2904); then dry it and powder it fine. Place a bottle containing 1 pint oil of turpentine in a water-bath, and add the powdered copal to the turpentine in small portions at a time; in a few days decant the clear. Dries slowly, but is very pale and durable, and is used for pictures, &c. In making this varnish, it frequently happens that the gum will not melt as readily as it ought, which, in general, is owing to the turpentine not being sufficiently rectified; but, when that is good, it will always succeed. It is best also to let the turpentine be exposed for some time in the sun, in a corked bottle, that the watery particles may be gradually dissipated. The bottle should not be stopped quite tight.

2908. Copal Varnish, according to Professor Boettger should be made by first dissolving 1 part by weight of camphor, in 12 parts ether; when the camphor is dissolved, 4 parts best copal resin, previously reduced to an impalpable powder, are added to the ethereal camphor solution placed in a well-stoppered bottle. As soon as the copal appears to be partly dissolved, and has become swollen, 4 parts strong alcohol, or methylated spirits, and ¼ part oil of turpentine are added, and, after shaking the mixture and letting it stand for a few hours longer, a thoroughly good copal varnish is obtained.

2909. Common Turpentine Varnish. This is merely clear pale resin dissolved in oil of turpentine; usually 5 pounds resin to 7 pounds of turpentine.

2910. Crystal Varnish. Picked mastich, 4 ounces; rectified spirit, 1 pint; animal charcoal, 1 ounce. Digest and filter.

2911. Mastich Picture Varnish. Very pale and picked gum mastich, 5 pounds; glass pounded as small as barley, and well washed and dried, 2½ pounds; rectified turpentine, 2 gallons; put them into a clean 4 gallon stone or tin bottle, bung down securely, and keep rolling it backwards and forwards pretty smartly on a counter or any other solid place, for at least 4 hours; when, if the gum is all dissolved, the varnish may be decanted, strained through muslin into another bottle, and allowed to settle. It should be kept for 6 or 9 months before use, as it thereby gets both tougher and clearer. Very fine.

2912. Mastich Varnish. Mastich, 8 pounds; turpentine, 4 gallons; dissolve by a gentle heat, and add pale turpentine varnish, ½ gallon.

2913. Best Mastich Varnish. Gum mastich, 6 ounces; oil of turpentine 1 quart; dissolve. Mastich varnish is used for pictures, &c.; when good, it is tough, hard, brilliant, and colorless.

2914. Varnish for Paintings. Take mastich, 6 ounces; pure turpentine, ½ ounce; camphor, 2 drachms; spirits of turpentine, 19 ounces; add first the camphor to the turpentine; the mixture is made in a water-bath; when the solution is effected, add the mastich and the spirits of turpentine near the end of the operation; filter through a cotton cloth.

2915. Tingry's Essence Varnish. Mastich in powder, 12 ounces; pure turpentine, 1½ ounces; camphor, ½ ounce; powdered glass, 5 ounces; rectified oil of turpentine, 1 quart.

2916. White Toy Varnish. Tender copal, 7½ ounces; camphor, 1 ounce; alcohol of 95 per cent., 1 quart; dissolve, then add mastich, 2 ounces; Venice turpentine, 1 ounce; dissolve and strain. Very white, drying, and capable of being polished when hard. Used for toys.

2917. White Varnish. Sandarach, 8 ounces; mastich, 2 ounces; Canada balsam, 4 ounces; alcohol, 1 quart. Used on paper, wood, or linen.

2918. Best White Hard Varnish. Rectified spirits of wine, 1 quart; gum sandarach, 10 ounces; gum mastich, 2 ounces; gum anime, ½ ounce; dissolve these in a clean can, or bottle, in a warm place, frequently shaking it. When the gum is dissolved, strain it through a lawn sieve, and it is fit for use.

2919. Mordant, or Transfer Varnish. Mastich in tears, 6½ ounces; resin, 12½ ounces; pale Venice turpentine (genuine) and sandarach, of each 25 ounces; alcohol, 5 pints; dissolve as before. Used for fixing engravings or lithographs on wood, and for gilding, silvering, &c. (*See No.* 2928.)

2920. Map Varnish is prepared by pulverizing 1 ounce sandarach, ¼ ounce mastich, ¼ ounce elemi, dissolving them in ½ ounce of Venice turpentine, and adding to it a solution of 4 ounces shellac, and 3 ounces oil of lavender, in 12 ounces alcohol. (*See No.* 2935.)

2921. Canada Varnish. Clear balsam of Canada, 4 ounces; camphene, 8 ounces; warm gently, and shake together till dissolved. For maps, drawings, &c., they are first sized over with a solution of isinglass, taking care that every part is covered; when dry, the varnish is brushed over it.

2922. Collodion Varnish. The addition of 1 part castor oil to 32 parts collodion, makes a good varnish; it dries rapidly and does not penetrate the paper. This varnish will do very well for coating maps, lists, labels, etc., and it will keep for years. If, after a repeated coating, white spots should appear, moisten them with ether, and they will vanish instantly.

2923. Varnish to Imitate the Chinese. Put 4 ounces powdered gum-lac, with a piece of camphor about the size of a hazelnut, into a strong bottle, with 1 pound good spirits of wine. Shake the bottle from time to time, and set it over some hot embers to mix for 24 hours, if it be in winter; in summer time it may be exposed to the sun. Pass the whole through a fine cloth, and throw away what remains upon it. Let it settle for 24 hours; separate gently the clear part in the upper part of the bottle, and put into another phial; the remains will serve for the first layers or coatings.

2924. Varnish for Drawings and Lithographs. Take of dextrine, 2 parts; alcohol, ½ part; water, 2 parts. These should be prepared previously with 2 or 3 coats of thin starch or rice boiled and strained through a cloth. (*See No.* 2927.)

2925. To Purify Dextrine. Hager gives a method for rendering dextrine pure, or at least freer from foreign odor and taste. For this purpose he dissolves 10 parts of good dextrine, with stirring, in 18 of cold distilled water, allows the mixture to stand for some days, decants and strains it from the sediment. The clear liquid is then to be mixed with once and a half to twice its volume of alcohol fortius (*see No.* 1439); after some hours the liquor is separated from the pasty mass, which is then once more dissolved in a small quantity of water, and spread on glass or porcelain to dry at a temperature not exceeding 140° Fahr.

2926. Le Blond's Varnish. Keep 4 pounds balsam of copaiba warm in a sand or water bath, and add 16 ounces copal (previously fused and coarsely powdered), by single ounces, daily, and stir it frequently. When dissolved add a little Chio turpentine.

2927. De Sylvestre's Dextrine Varnish. Dextrine, 2 parts; water, 6 parts: rectified spirit, 1 part. (*See No.* 2924.)

2928. Transfer Varnish. For transferring and fixing engravings or lithographs on wood, and for gilding, silvering, etc. Dissolve 4 ounces mastich (in tears), and 4 ounces sandarach, in 1½ pints rectified spirit; add ½ pint pure Canada balsam. (*See No.* 2919.)

2929. To Dissolve Amber. There is no difficulty in dissolving amber in chloroform, but people are apt to think they fail, from the circumstance that it is only partially soluble. Take some broken amber, reduce to a coarse powder, and place in a bottle with rather more than enough chloroform to cover them well; shake often, and in a few days, by pouring a drop or two of the clear liquid on a glass plate, a varnish of good body, which gives a strong glaze, may be obtained. Or an amber varnish may be made as follows: Take of amber, 3 ounces; benzole, 50 ounces; heat the amber in a closed vessel to a temperature of about 570° Fahr. When it begins to soften and swell, emitting white fumes, then dissolve in the benzole.

2930. Amber Varnish for Photographs. Dissolve 3 to 4 grains amber in 1 ounce chloroform. (*See No.* 2929.)

2931. Brilliant Amber Spirit Varnish. Fused amber, 4 ounces; sandarach and mastich, of each 4 ounces; highly rectified spirit, 1 quart. Expose to the heat of a sand-bath, with occasional agitation, till dissolved. (The amber is fused in a close copper vessel, having a funnel-shaped projection, which passes through the bottom of the furnace by which the vessel is heated.)

2932. Hare's Colorless Varnish for Photographs. Dissolve shellac by heat in 8 parts of water and 1 of pearlash. Precipitate by chlorine, and dissolve in rectified spirit. (*See Nos.* 2933 to 2935.)

2933. Bookbinders' and Colorless Varnish. Mr. A. Schmidt gives the following directions for making these and several other beautiful varnishes: For 1 pound good shellac take 4 ounces crystallized carbonate of soda, and 1½ gallons water; put the whole in a clean iron or copper vessel of double the capacity, and, under constant stirring, bring it to boiling over a slow fire. The shellac will dissolve, and, if it is intended to make colorless French varnish (*see No.* 2935), the solution has to be run through a woolen cloth. For brown bookbinders' varnish, or a colorless varnish for maps, photographs, etc., the solution has to boil for about an hour longer, but only simmering, and then to cool very slowly without stirring; better let it stand over night, and let the fire go out under it. In the morning a wax-like substance will be found on the surface of the solution, and the other impurities of the shellac as a deposit on the bottom of the vessel. The solution is likewise to be run through a woolen cloth and then to be filtered. (*See No.* 2934.) To make a transparent brown varnish—bookbinders' varnish—this filtered solution has to be precipitated with diluted sulphuric acid (1 part acid to 20 parts water), the precipitate collected on a coarse muslin cloth, and washed out with cold clear water till it runs through without taste. (*See No.* 24.) Then fill a stone or wooden vessel with boiling water, and throw the precipitate in it; it will directly soften and stick together; this half mass has to be kneaded in the hands, doubled up, melted, and drawn out till it assumes a fine silky lustre, then drawn out to the desired thickness in sticks, like candy, and it is then ready for solution. To make the BOOKBINDERS' VARNISH, dissolve 1 part of the precipitate in 2½ parts 95 per cent. alcohol. To make the COLORLESS VARNISH, dissolve 1 part of the precipitate in the same quantity of alcohol. Add 1½ drachms oil of lavender to each pint. The colorless varnish will look like whey, but more transparent.

2934. Filter for Shellac. To make a filter for shellac, take a small wooden keg, remove the top and bottom, and fasten to one side a piece of muslin; on the muslin bring about 4 inches fine, washed sand, and on top of the sand a layer of clean straw; then pour the solution into the filter and let it run through. Should the first portion run through be not perfectly clear, like red French wine, it has to be brought back to the filter. When nothing more will run through, pour some clean water on the filter to wash the remaining solution out.

2935. French Transparent Colorless Varnish. To make white French transparent colorless varnish for maps, the solution (*see No.* 2933) has to be bleached. The bleaching fluid is made as follows, and the proportions are for 1 pound of shellac: Take 1 pound good English chloride of lime, dissolve it in 14 pounds cold water, triturating the lumps well; let it subside, and decant the clear fluid; add 7 pounds of water to the residue, and, when subsided, add the clear liquor to the other; precipitate this liquor with a solution of carbonate of soda, let the carbonate of lime settle, and decant the clear chloride of soda; wash the sediment out with water, and add the clear liquid to the former, put it in a high stone jar, and give it a rotary motion with a wooden stick, pouring in at the same time very diluted sulphuric acid, till it assumes a greenish color and a smell of chlorine is perceptible. Then add some of this liquid to the solution to be bleached, under constant stirring, till all the color is gone. French polish will look like milk. Then precipitate with dilute sulphuric acid, exactly as the solution for bookbinders' varnish, and treat the precipitate in the same manner, in hot water. (*See No.* 2933.) All iron must be carefully avoided as soon as the chlorine liquor is added. Dissolve 1 pint of the above in 3 pints of 95 per cent. alcohol, and do not add any oil of lavender, as in No. 2933. For photographs this solution is too strong; 1 part of bleached shellac to 6 parts alcohol will answer. For maps the solution should not be applied immediately to the paper, but the latter should first receive a coat of boiled and strained starch.

2936. Wax Varnish, or Milk of Wax. Pure white wax, 1 pound; melt with as gentle a heat as possible, and warm spirit of wine (90 per cent.), 1 pint; mix perfectly, and pour the liquid out upon a cold porphyry slab; next grind it with a muller to a perfectly smooth paste, with the addition of more spirit as required; put the paste into a marble mortar, make an emulsion with 3½ pints gradually added, and strain through muslin. Used as a varnish for paintings; when dry, a hot iron is passed over it, or heat is otherwise evenly applied, so as to fuse it, and render it transparent; when quite cold it is polished with a clean linen cloth. The most protective of all varnishes. Many ancient paintings owe their freshness at the present day to this varnish.

2937. Wax Varnish for Furniture. Wax, 3 ounces; oil of turpentine, 1 quart; dissolve by a gentle heat. Used for furniture.

2938. Varnish for Paper Hangings, Maps, Prints, &c. Take of genuine pale Canada balsam and rectified oil of turpentine, equal parts, and mix thoroughly. Give the articles 2 coats of size before varnishing.

2939. Varnish for Card-Work, Baskets, &c. Take black, red, or any other colored sealing-wax, according to fancy; break it into small pieces, and add enough rectified or methylated spirit to cover it; let the vessel stand near the fire for 2 days until it is quite dissolved. Give the article 2 coats of size before varnishing. The size is made by dissolving parchment cuttings in boiling water. This is a most useful varnish for fret-work, card-work, baskets, &c.

2940. Water Lac Varnish. Pale shellac, 5 ounces; borax, 1 ounce; water, 1 pint; digest at nearly the boiling point, until dissolved; then strain. Equal to the more costly spirit varnish for many purposes; it is an excellent vehicle for water colors, inks, &c.; when dry it is waterproof.

2941. Transparent Green Varnish. A beautifully transparent green varnish is made by taking a small quantity of "Chinese blue," with about twice the amount of finely powdered chromate of potash, and stirring these in copal varnish thinned with turpentine. A thorough grinding of this mixture must be made for the purpose of intimately incorporating the ingredients, as otherwise it will not be transparent. A preponderance of chromate of potash gives a yellowish shade to the green, and a deficiency increases the amount of blue. This varnish, thus colored, produces a very striking effect in japanned goods, paper-hangings, etc., and can be made very cheaply.

2942. Aniline Transparent Varnishes. The aniline colors are particularly well adapted for the manufacture of transparent lacs, which possess great intensity even in very thin films, and are hence very suitable for coloring glass or mica. The process recommended by F. Springmuhl is to prepare separately an alcoholic solution of bleached shellac or sandarach, and a concentrated alcoholic solution of the coloring matter, which last is added to the lac before using it; the glass or mica to be coated being slightly warmed. Colored films of great beauty may also be obtained, according to Springmuhl, from colored solutions of gun cotton in ether, the coloring matter being here dissolved in alcohol and ether. The collodion film has its elasticity greatly increased by the addition of some turpentine oil; and when applied cold, can be removed entire. The colored films may now be cut into any pattern, and again attached to transparent objects.

2943. Aniline Black Varnish. An aniline black varnish, of recent Parisian production, is the following: Dissolve 6¾ drachms avoirdupois of aniline blue, 1¾ drachms of fuchsine, and 4½ drachms of naphthaline yellow, in 1 quart alcohol. The whole is dissolved by agitation in less than 12 hours. One application renders an object ebony black; the varnish can be filtered, and will never deposit afterwards.

2944. Transparent Varnish for Prints and Pictures. Dilute ¼ pound Venice turpentine with a gill, or thereabouts, of spirits of wine. If too thick, a little more of the latter; if not enough, a little more of the former; so that it is brought to the consistence of milk. Lay 1 coat of this on the right side of the print, and, when dry, it will shine like glass. If it is not satisfactory, lay on another coat.

2945. To Make the Design of a Print Appear in Gold. After having laid on both sides of the print one coat of the varnish described in No. 2944, in order to make it transparent, let it dry a little while; then, before it is quite dry, lay some gold in leaves on the wrong side of the print, pressing it gently on with a cotton pad. By these means, all parts where these leaves have been laid will appear like massive gold on the right side. When this is all thoroughly dry, lay on the right side of it one coat of the varnish described above, and it will then be as good as any crown glass. A pasteboard may be put behind the print, to support it better in its frame.

2946. Clear Gutta-Percha Solution. Cut gutta-percha into thin strips and put it in a glass bottle, and add as much chloroform as makes a thick paste. This paste is then placed in very hot water, and kneaded with the fingers. After considerable manipulation the gutta-percha loses much of its color, and if this process is repeated, becomes very nearly colorless, having only a pale straw tint. A chloroform solution may then be made of any strength, which is useful for many purposes—when thin, as a substitute for court plaster, and when thick, as a stopping for decayed teeth.

2947. Solvents for India-Rubber and Gutta-Percha to Make Flexible Varnish. Rubber does not dissolve easily enough to give a varnish by simply placing it in a bottle with the solvent. Sulphuric ether is one of its regular solvents, but then it must be pure rectified ether, and not the mixture of ether and alcohol which is sold for ether in many drug stores. It also must be pure rubber, and not the sulphur-vulcanized article. The pure rubber must be cut into small pieces, soaked in the ether in a warm place for about 24 hours until they are swollen up, and then it must be kneaded in a mortar. In such a way rubber varnishes may be made even with common benzine. When treated with hot benzole (from coal tar, not benzine from petroleum), it swells to 30 times its former bulk; and if then triturated with a pestle, and pressed through a sieve, it affords a homogeneous varnish, which being applied by a flat edge of metal or wood to cloth, prepares it for forming waterproof cloth. Chloroform and the bisulphuret of carbon dissolve India-rubber and gutta-percha in the cold. Turpentine disintegrates and dissolves India-rubber and gutta-percha when hot. The fixed oils also readily dissolve them with the aid of heat. When India-rubber remains sticky after working it, it is a proof that the temperature was too high, or that too much turpentine was used in the solutions or varnishes; turpentine rubber varnish has naturally a tendency to dry sticky; benzole or the fixed oils are better. (*See No.* 2248.)

2948. Flexible Varnish for Balloons, etc. Digest cold, 1½ ounces India-rubber, cut small, in 1 pint of either chloroform, sulphuric ether (washed), or bisulphuret of carbon. This dries as soon as laid on.

2949. India-Rubber Varnish. Digest in a closed vessel, at a gentle heat, 1 ounce India-rubber shavings in 1 pint of rectified mineral naphtha, or benzole; then strain it. This dries very badly, and never gets perfectly hard.

2950. Tough India-Rubber Varnish. Dissolve by heat 1 ounce India-rubber in 1 quart of drying oil. This dries very tough in about 48 hours.

2951. Flexible Varnish. Boil 3 ounces dried white copperas, 3 ounces sugar of lead, and 8 ounces litharge, in 1 gallon linseed oil; stir constantly until it strings well, then cool slowly and decant the clear portion. If too thick, thin with quick-drying linseed oil.

2952. Colpin's India-Rubber Varnish. India-rubber in small pieces, washed and dried, are fused for 3 hours in a close vessel, on a gradually heated sand-bath. On removing from the sand-bath, open the vessel and stir for 10 minutes, then close again, and repeat the fusion on the following day, until small globules appear on the surface. Then strain through a wire sieve.

2953. Metallic Varnish, or Varnisher's Amalgam. Melt 4 ounces grain tin (*see Index*) with 1 ounce bismuth; add 1 ounce quicksilver, and stir till cold; then grind it very fine with white of egg or varnish, and apply this metallic varnish to the figure to be coated.

2954. Varnish for Gun Barrels. The varnish used for gun barrels, after they are bronzed, is made by dissolving 1 ounce of shellac and 1 or 2 drachms of dragon's blood in a quart of alcohol, and filtering the solution through blotting paper into a bottle, which must be kept closely corked. This varnish, being laid on the barrel, and become perfectly dry, must be rubbed with a burnisher to render it smooth and glossy.

2955. Submarine Varnish. Resin, 2 parts; galipot, 2 parts; essence of turpentine, 40 parts. Melt the above, and add, in the form of very fine powder, and well mixed, sulphide of copper, 18 parts; regulus of antimony, 2 parts. This varnish is said to protect wood from worms, and to prevent the adherence of barnacles and parasites to the bottom of ships. It also preserves iron from oxidation.

2956. Varnish for Iron. The following is a method given by M. Weiszkopf, of producing upon iron a durable black shining varnish: Take oil of turpentine, add to it, drop by drop, and while stirring, strong sulphuric acid, until a syrupy precipitate is quite formed, and no more of it is produced on further addition of a drop of acid. The liquid is now repeatedly washed away with water, every time renewed after a good stirring, until the water does not exhibit any more acid reaction on being tested with blue litmus paper. The precipitate is next brought upon a cloth filter, and, after all the water has run off, the syrupy mass is fit for use. This thickish deposit is painted over the iron with a brush; if it happens to be too stiff, it is previously diluted with some oil of turpentine. Immediately after the iron has been so painted, the paint is burnt in by a gentle heat, and, after cooling, the black surface is rubbed over with a piece of woolen stuff dipped in, and moistened with linseed oil. According to Weiszkopf, this varnish is not a simple covering of the surface, but it is chemically combined with the metal, and does not, therefore, wear or peel off the iron, as is the case with other paints and varnishes.

2957. **Brilliant French Varnish for Boots and Shoes.** Take ¾ of a pint spirits of wine; 5 pints white wine; ½ pound powdered gum senegal; 6 ounces loaf sugar; 2 ounces powdered galls; 4 ounces green copperas. Dissolve the sugar and gum in the wine. When dissolved, strain; then put it on a slow fire, being careful not to let it boil. In this state put in the galls, copperas, and the alcohol, stirring it well for five minutes. Then remove from the fire, and, when nearly cool, strain through flannel, and bottle for use. It is applied with a pencil brush. If not sufficiently black, a little sulphate of iron, and half a pint of a strong decoction of logwood, may be added, with $\frac{1}{16}$ ounce pearlash.

2958. **Varnish for Fastening the Leather on Top Rollers in Factories.** Dissolve 2¾ ounces of gum-arabic in water and a like amount of isinglass dissolved in brandy, and it is fit for use.

2959. **Varnish for Engraving on Glass.** Wax, 1 ounce; mastich, ½ ounce; asphaltum, ¼ ounce; turpentine, ½ drachm.

2960. **Etching Varnishes.** White wax, 2 ounces; asphaltum, 2 ounces. Melt the wax in a clean pipkin, add the asphaltum in powder, and boil to a proper consistence. Pour it into warm water, and form it into balls, which must be kneaded, and put into taffeta for use. Or: white wax, 2 ounces; Burgundy pitch, ½ ounce; black pitch, ½ ounce. Melt together, and add by degrees 2 ounces powdered asphaltum, and boil it till a drop cooled on a plate becomes brittle.

2961. **Etching Fluid for Copper.** Aquafortis, 2 ounces; water, 5 ounces. Mix.

2962. **Callot's Eau Forte for Fine Touches.** Dissolve 4 parts each of verdigris, alum, sea salt, and sal ammoniac, in 8 parts vinegar; add 16 parts water, boil for a minute, and let it cool.

2963. **Etching Fluid for Steel.** Iodine, 1 ounce; iron filings, ½ drachm; water, 4 ounces. Digest till the iron is dissolved. Or: pyroligneous acid, 4 parts by measure; alcohol, 1 part. Mix, and add 1 part double aquafortis (specific gravity 1.28). Apply it from 1½ to 15 minutes.

2964. **To Make Colored Prints Resemble Oil Paintings.** Take of Canada balsam, 1 ounce; spirit of turpentine, 2 ounces; mix them together. Before this composition is applied, the drawing or print should be sized with a solution of isinglass in water, and, when dry, the varnish should be applied with a camel's-hair brush.

2965. **To Varnish Drawings, or any Kind of Paper or Card Work.** Dissolve 1 ounce best isinglass in about 1 pint water, by simmering it over the fire; strain it through fine muslin, and keep it for use. Try the size on a piece of paper moderately warm. If it glistens, it is too thick, and requires more water; if it soaks into the paper, it is too thin, and needs more isinglass; it should merely dull the surface. Then give the drawing 2 or 3 coats, letting it dry between each, being careful (particularly in the first coat) to bear very lightly on the brush (which should be a flat camel's-hair), from which the size should flow freely; otherwise, the drawing may be damaged. Then take the best mastich varnish, and with it give at least 3 coats. This is the method used by many eminent artists, and is found superior to any that has been tried.

2966. **Varnish for Shoes.** Put ½ pound gum shellac, broken up in small pieces, into a quart bottle or jug, cover it with alcohol, cork it tight, and put it on a shelf in a warm place; shake it well several times a day, then add a piece of camphor as large as a hen's egg, shake it well, and in a few hours shake it again and add 1 ounce lampblack. If the alcohol is good it will all be dissolved in 2 days; then shake and use. If it gets too thick, add alcohol, pour out 2 or 3 tea-spoonfuls in a saucer, and apply it with a small paint brush. If the materials are all good it will dry in about 5 minutes, giving a gloss equal to patent leather, and will be removed only by wearing it off. The advantage of this preparation over others is, it does not strike into the leather and make it hard, but remains on the surface, and yet excludes the water almost perfectly. The same preparation is admirable for harness, and does not soil when touched, as is usually the case with lampblack preparations.

2967. **Varnish for Harness.** Take 95 per cent. alcohol, 1 gallon; white pine turpentine, 1½ pounds; gum shellac, 1½ pounds; Venice turpentine, 1 gill. Let these stand in a jug in the sun or by a stove until the gums are dissolved, then add sweet oil, 1 gill; and lampblack, 2 ounces; rub the lampblack first with a little of the varnish. This varnish is better than the old style, from the fact that its polish is as good, and it does not crack when the harness is twisted or knocked about.

2968. **Flexible Japan Black for Leather.** Burnt umber, 8 ounces; true asphaltum, 3 or 4 ounces; boiled linseed oil, 1 gallon; grind the umber with a little of the oil; add it to the asphaltum, previously dissolved in a small quantity of the oil by heat; mix, add the remainder of the oil; boil, cool, and thin with a sufficient quantity of oil of turpentine.

2969. **Inflexible Japan Black for Leather.** Shellac, 1 ounce; wood naphtha, 4 ounces; lampblack to color; dissolve.

2970. **Varnish or Enamel for Coating the Insides of Casks.** A new application of charcoal has recently been made in England for the manufacture of a permanent enamel, or varnish for coating the insides of casks. The charcoal, which is made from the wood of Salix Alba (white willow), is reduced to a very fine powder, and mixed with proper proportions of shellac and methylated spirit. When ready for use it is laid on with a brush, and the inside of the cask is fired, so as to remove the spirit and leave only the lining of charcoal and shellac; it is then coated again and fired a second time, after which it is allowed to stand a short time before being used. This composition is said to form a perfect enamel, and, while it prevents any chance of leakage, it preserves the casks in an extraordinary manner. It answers admirably for beer and acids, and is largely adopted by some of our principal brewers.

Varnishing.

The art of applying varnishes to various surfaces. This requires experience and care, both in the selection of appropriate varnishes, and in the manner of applying them.

2972. To Finish Walnut Wood for Varnishing. Mix, with good whiting, such colors as will produce as near as possible the color of the wood to be filled. This mixture to be dry. Then give the wood a good coat of oil, and sprinkle the mixture over the work until it is pretty well covered; then, with a soft rag or other soft substance, rub this in well. Wipe off all superfluous material. Let dry thoroughly, and varnish. This mode is far superior to sizing.

2973. Finishing Walnut. For filling walnut wood, there are many compounds in use, several of them under patents; that which discolors the wood the least, and at the same time produces a fine finish, is the most simple of them all, being nothing but fine rye flour mixed with boiled oil, Japan and turpentine, ground fine in a paint mill, and slightly colored with burnt umber.

2974. To Varnish Walnut Furniture. In dressing over old furniture, the first thing to be done is to wash it over with lime, or soda and water, to remove all effects of grease from sweaty hands, which will prevent varnish from flowing freely or hardening well. If the work requires refilling, rye flour, wheat flour, corn starch, or Paris white, ground fine in oil and turpentine, will do; but 1 or 2 coats of shellac should be laid on and rubbed smooth before applying the varnish. Work finished in oil, without varnish, should be filled with a harder substance than starch. Some use white wax reduced in turpentine; but what is better is a compound of equal parts, by weight, of whiting, plaster of Paris, pumice stone, and litharge, to which may be added a little French yellow, asphaltum, vandyke brown, and terra di Sienna. Mix with 1 part Japan, 2 of boiled oil, and 3 of turpentine. Grind fine in a mill. Lay the filling on with a brush, rub it in well, let it set 20 minutes, then rub off clean. Let it harden 2 or 3 days, then rub smooth, and, if required, repeat the process. When the filling is satisfactory, finish with linseed oil, put on with a brush; wipe off, and rub to a polish with fine cotton; finish with a silk handkerchief, or any fine fabric. When the furniture is cleaned and filled, proceed as directed in the next receipt.

2975. To Varnish Furniture. When the work is quite clean, fill up all knots or blemishes with cement of the same color. See that the brush is clean, and free from loose hairs; then dip it in the varnish, stroke it along the wire raised across the top of the varnish pot, and give the work a thin and regular coat. This must be done as quickly as possible; and yet not quickly enough to cause the varnish to foam or bubble as it leaves the brush, always taking care not to pass the brush twice over the same place, if it can possibly be avoided. Let it stand to dry in a moderately warm place, that the varnish may not chill. Varnish must always be applied in a moderately warm room, where the air is dry and free from dust; and care must be taken never to apply a second coat until the former one has become quite dry. It requires practice to find out how much varnish to take in the brush. Enough must be left on an upright surface to ensure a perfect coating; but too much will settle downwards before it sets and make unsightly ridges as it dries. On a horizontal surface, a trifle more varnish can be applied than on an upright one, but not much more; as a too thick coating, even if it cannot run, will dry neither hard nor smooth. After giving the work about 6 or 7 coats, let it get quite hard (which you will prove by pressing your knuckles on it; if it leave a mark, it is not hard enough); then, with the first three fingers of the hand, rub the varnish until it chafes, and proceed over that part of the work you mean to polish, in order to take out all the streaks or partial lumps made by the brush; then give it another coat, and let it stand a day or two to harden. The best vessel for holding varnish is sold at color shops, called a varnish pan. It is constructed of tin, with a false bottom; the interval between the two bottoms is filled with sand, which, being heated over the fire, keeps the varnish fluid, and it flows more readily from the brush. There is a tin handle to it, and the false bottom slopes from one end to the other, which causes the varnish to run to one end. It has also a wire fixed across the top, to wipe the brush against.

2976. To Polish Varnished Surfaces. To give the highest degree of lustre to varnish after it is laid on, as well as to remove the marks of the brush, it undergoes the operation of polishing. This is performed by first rubbing it with very finely powdered pumice stone and water; afterwards, patiently, with an oiled rag and Tripoli until the required polish is produced. The surface is then cleaned off with soft linen cloths, cleared of all greasiness with powdered starch, and then rubbed bright with the palm of the hand.

2977. To Keep Brushes in Order. The brushes used for varnishing are either flat in tin, or round, tied firm to the handle, and made either of camel's-hair or very fine bristles. Oil varnishes are applied with brushes of fine bristles; lac varnishes are flowed on with camel's-hair brushes. It is necessary to be very careful in cleaning them after being used; for, if laid by with the varnish in them, they are soon spoiled. Therefore, after using, wash them well in spirits of wine or turpentine, according to the nature of the varnish; after which they may be washed out with hot water and soap, when they will be as good as new, and last a great while with care. The spirits that are used for cleaning may be used to mix with varnish for the more common purposes, or the brushes may be cleaned merely with boiling water containing a little washing soda, and strong yellow soap.

2978. To Restore Furniture. An experienced cabinet-maker informs us that the best preparation for cleaning picture frames and restoring furniture, especially that somewhat marred or scratched, is a mixture of three parts of linseed oil and one part spirits of turpentine. It not only covers the disfigured surface, but restores wood to its original color, and leaves a lustre upon the surface. Put on with a woolen cloth, and when dry, rub with woolen.

Polishing.

The beauty of cabinet-work depends upon the care with which it is finished. Some clean off with scraping and rubbing with glass paper. This should be done in all cases; but it is not enough, particularly where the grain is at all soft. A good glass-paper also is essential. (*See No.* 1933.) A polish should then be added. But, unless the varnish for cabinet-work be very clear and bright, it will give a dingy shade to all light-colored woods. This should, therefore, be a previous care. Again, some workmen polish with rotten stone, others with putty-powder, and others with common whiting and water; but Tripoli will be found to answer the best.

2980. To Polish Varnish is certainly a tedious process, and considered by many as a matter of difficulty. Put 2 ounces powdered Tripoli into an earthen pot or basin, with water sufficient to cover it; then, with a piece of fine flannel four times doubled, laid over a piece of cork rubber, proceed to polish the varnish, always wetting it well with the Tripoli and water. It will be known when the process is complete by wiping a part of the work with a sponge, and observing whether there is a fair and even gloss. Clean off with a bit of mutton-suet and fine flour. Be careful not to rub the work too hard, or longer than is necessary to make the face perfectly smooth and even.

2981. The French Method of Polishing. With a piece of fine pumice-stone, and water, pass regularly over the work with the grain until the rising of the grain is down; then, with powdered Tripoli and boiled linseed oil, polish the work to a bright face. This will be a very superior polish, but it requires considerable time.

2982. To Polish Brass Ornaments Inlaid in Wood. The brass-work must first be filed very even with a smooth file; then, having mixed some very finely powdered Tripoli with linseed oil, polish the work with a rubber made from a piece of old hat or felt, as you would polish varnish, until the desired effect is produced. If the work be ebony, or black rosewood, take some elder-coal, powdered very fine, and apply it dry after you have done with the Tripoli. It will increase the beauty of the polish.

2983. To Clean Soft Mahogany or other Porous Wood. After scraping and sand-papering in the usual manner, take a sponge and well wet the surface, to raise the grain; then, with a piece of fine pumice-stone, free from stony particles, and cut the way of the fibres, rub the wood in the direction of the grain, keeping it moist with water. Let the work dry; then wet it again, and the grain will be much smoother, and will not raise so much. Repeat the process, and the surface will become perfectly smooth, and the texture of the wood much hardened. If this does not succeed to satisfaction, the surface may be improved by using the pumice-stone with cold-drawn linseed oil, proceeding in the same manner as with water. This will be found to give a most beautiful as well as a durable face to the work, which may then be polished or varnished.

2984. To Clean and Finish Mahogany Work. Scrape and sand-paper the work as smooth as possible; go over every part with a brush dipped in furniture oil, and let it remain all-night; have ready the powder of the finest red brick, which tie up in a cotton stocking, and sift equally over the work the next morning, and, with a leaden or iron weight in a piece of carpet, rub it well the way of the grain, backward and forward, till it has a good gloss. If not sufficient, or if the grain appears at all rough, repeat the process. Be careful not to put too much of the brick-dust, as it should not be rubbed dry, but rather as a paste upon the cloth. When the surface is perfectly smooth, clean it off with a rubber of carpet and fine mahogany saw-dust. This process will give a good gloss, and make a surface that will improve by wear.

2985. To Clean and Polish Old Furniture. Take a quart of stale beer or vinegar, put a handful of common salt and a table-spoonful of muriatic acid into it, and boil it for 15 minutes; it may be kept in a bottle, and warmed when wanted for use. Having previously washed the furniture with soft hot water, to get the dirt off, wash it carefully with the above mixture; then polish, according to the directions, with any of the foregoing polishes.

2986. Mixture for Cleaning Furniture. Cold-drawn linseed oil, 1 quart; spirit of wine, and vinegar, ½ pint each; butter (terchloride) of antimony, 2 ounces; spirit of turpentine, ½ pint. This mixture requires to be well shaken before it is used. A little of it is then to be poured upon a rubber, which must be well applied to the surface of the furniture; several applications will be necessary for new furniture, or for such as had previously been French polished or rubbed with bees' wax.

2987. Furniture Polish. Dissolve 4 ounces best shellac in 2 pints 95 per cent. alcohol; add to this 2 pints linseed oil, and 1 pint spirits of turpentine; when mixed, add 4 ounces sulphuric ether, and 4 ounces ammonia water; mix thoroughly. Shake when used, and apply with a sponge lightly. This is an excellent article, especially where the varnish has become old and tarnished.

2988. Polishing Paste. Take 3 ounces white wax, ½ ounce Castile soap, 1 gill turpentine. Shave the wax and soap very fine and put the wax to the turpentine; let it stand 24 hours; then boil the soap in 1 gill water, and add to the wax and turpentine. This has been highly recommended.

2989. Furniture Polish. Bees' wax, ½ pound; alkanet root, ¼ ounce; melt together in a pipkin until the former is well colored. Then add linseed oil, and spirits of turpentine, of each ½ gill; strain through a piece of coarse muslin.

2990. Furniture Paste. Turpentine, 1 pint; alkanet root, ½ ounce; digest until sufficiently colored, then add bees' wax, scraped small, 4 ounces; put the vessel into hot water and stir until dissolved. If wanted pale, the alkanet may be omitted.

2991. Composition for Soft or Light Mahogany. Boil together cold-drawn linseed oil, and as much alkanet root as it will cover, and to every pint of oil add 1 ounce of the best rose pink. When all the color is extracted, strain it off, and to every pint add ½ gill spirits of turpentine. This will be a very superior composition for soft and light mahogany.

2992. To Wax Furniture. In waxing, it is of great importance to make the coating as thin as possible, in order that the veins of the wood may be distinctly seen. The following preparation is the best for performing this operation: Put 2 ounces white and yellow wax over a moderate fire, in a very clean vessel, and, when it is quite melted, add 4 ounces best spirits of turpentine. Stir the whole until it is entirely cool, and you will have a pomade fit for waxing furniture, which must be rubbed over it according to the usual method. The oil soon penetrates the pores of the wood, brings out the color of it, causes the wax to adhere better, and produces a lustre equal to that of varnish, without being subject to any of its inconveniences. The polish may be renewed at any time by rubbing it with a piece of *fine* cork.

French Polishing.

The method of varnishing furniture by means of rubbing it on the surface of the wood, is of comparatively modern date. To put on a hard face, which shall not be so liable to scratch as varnish, and yet appear equally fine, the French polish was introduced. Below we give a full direction of the process, and also the various preparations of the different compositions necessary.

2994. To French Polish. The varnish being prepared (shellac), the article to be polished being finished off as smoothly as possible with glass paper, and the rubber being made as directed below, proceed to the operation as follows:—The varnish, in a narrow-necked bottle, is to be applied to the middle of the flat face of the rubber, by laying the rubber on the mouth of the bottle and shaking up the varnish once, as by this means the rubber will imbibe the proper quantity to varnish a considerable extent of surface. The rubber is then to be enclosed in a soft linen cloth, doubled, the rest of the cloth being gathered up at the back of the rubber to form a handle. Moisten the face of the linen with a little raw linseed oil, applied with the finger to the *middle* of it. Place the work opposite the light, pass the rubber quickly and lightly over its surface uniformly in small circular strokes, until the varnish becomes dry, or nearly so; again charge the rubber as before with varnish (omitting the oil), and repeat the rubbing, until three coats are laid on, when a little oil may be applied to the rubber, and two coats more given to it. Proceed in this way until the varnish has acquired some thickness; then wet the inside of the linen cloth, before applying the varnish, with alcohol, or wood naphtha, and rub quickly, lightly, and uniformly, the whole surface. Lastly, wet the linen cloth with a little oil and alcohol without varnish, and rub as before till dry. Each coat is to be rubbed until the rag appears dry; and too much varnish must not be put on the rag at a time. Be also very particular in letting the rags be very clean and soft, as the polish depends, in a great measure, on the care taken in keeping it clean and free from dust during the operation. If the work be porous, or the grain coarse, it will be necessary to give it a coat of clear size previous to commencing with the polish; and, when dry, gently go over it with very fine glass paper. The size will fill up the pores, and prevent the waste of the polish, by being absorbed into the wood, and be also a saving of considerable time in the operation.

2995. To Make a French Polish Rubber. Roll up a strip of thick woolen cloth which has been torn off, so as to form a soft elastic edge. It should form a coil, from 1 to 3 inches in diameter, according to the size of the work. This rubber is to be securely bound with thread, to prevent it from uncoiling when it is used.

2996. Best French Polish. Shellac, 3 parts; gum mastich, 1 part; gum sandarach, 1 part; spirits of wine, 40 parts; the mastich and sandarach must first be dissolved in the spirits of wine, and then the shellac; the process may be performed by putting them into a bottle loosely corked, and placing it in a vessel of water heated to a little below 173° Fahr., or the boiling point of spirits of wine, until the solution be effected; the clear solution may be poured off into another bottle for use. Various receipts for the French polish have been published, in which ingredients are inserted that are insoluble in spirits of wine, and therefore useless; and others contain ingredients that are soluble in water, so as to render the mixture more easily injured.

2997. Common French Polish. A solution of shellac in wood naphtha, (pyroxilic spirit). (*See No.* 2999.)

2998. Mastich French Polish. Pale shellac, 3 pounds; mastich, 6 ounces; 90 per cent alcohol, 3 quarts. (*See next receipt.*)

2999. Sandarach French Polish. Shellac, 2 pounds; mastich and sandarach (both in powder), of each 1 ounce; copal varnish, 12 ounces; alcohol, 1 gallon. All the above are made in the cold by frequently stirring or shaking the ingredients together in a well-closed bottle or other vessel. French polish is used without filtering.

3000. True French Polish. To 1 pint spirits of wine add ½ ounce each gum copal and sandarach, and 1 ounce shellac. Let the gums be well bruised, and sifted through a piece of muslin. Put the spirits and the gums together in a vessel that can be closely corked; place them near a warm stove, and frequently shake them. In 2 or 3 days they will be dissolved. Strain the mixture through a piece of muslin, and keep it tight corked for use.

3001. French Polish. To 1 pint spirits of wine add ½ ounce gum shellac, the same quantity gum lac, and ¼ ounce gum sandarach; put these ingredients into a stone bottle near a fire, frequently shaking it; when the various gums are dissolved it is fit for use.

3002. French Polish. Take 2 ounces wood naphtha, ½ ounce best shellac, 1 drachm gum benzoin; crush the gums, mix them with the naphtha in a bottle; shake them frequently till dissolved; it is then ready for use. This is the clear polish. Take a little cotton wool, apply a little of the polish to it, cover it tightly with a linen rag, to which apply a drop of linseed oil, to prevent it from sticking to the wood; use your rubber gently, polishing from a centre in a circular manner; finish with a drop of spirits of wine on a clean rubber, which will extract the oil.

3003. To Stain or Color French Polish. Wood may be stained or grained any color or design, by mixing it with the polish, or dipping the rubber in the color (finely powdered), at the time you apply the polish. (*See No.* 3002.) To produce a red, dip the cotton into dragon's blood (finely powdered), immediately applying the polish; then cover with the linen, and polish. For yellow, use the best chrome yellow. For blue, ultramarine blue, or indigo. For black, ivory or lampblack, &c. Graining is produced by touching or streaking the wood with the color, as above, in irregular lines or marks, and in such shapes as the fancy may suggest, then finishing it with a coat of clear polish.

3004. Water-Proof Polish. Take 1 pint spirits of wine, 2 ounces gum-benzoin, ¼ ounce gum sandarach, and ¼ ounce gum anime; these must be put into a stoppered bottle, and placed either in a sand-bath or in hot water till dissolved; then strain the mixture, and, after adding about ¼ gill best clear poppy oil, shake it well up, and put it by for use.

3005. Bright Polish. 1 pint spirits of wine to 2 ounces gum benzoin and ½ ounce gum-sandarach, put in a glass bottle corked, and placed in a sand-bath or hot water until you find all the gum dissolved, will make a beautiful clear polish for Tunbridgeware goods, tea-caddies, &c. It must be shaken from time to time, and, when all dissolved, strained through a fine muslin sieve, and bottled for use.

3006. Prepared Spirits for Finishing Polish. This preparation is useful for finishing after any of the foregoing receipts, as it adds to the lustre and durability, as well as removing every defect, of the other polishes; and it gives the surface a most brilliant appearance. Take ½ pint best rectified spirits of wine, 2 drachms shellac, and 2 drachms gum-benzoin. Put these ingredients in a bottle, and keep it in a warm place till the gum is all dissolved, shaking it frequently; when cold, add 2 tea-spoonfuls of the best clear white poppy oil; shake them well together, and it is fit for use. This preparation is used in the same manner as the foregoing polishes; but, in order to remove all dull places, the pressure in rubbing may be increased.

3007. Strong Polish. To be used in the carved parts of cabinet-work with a brush, as in standards, pillars, claws, &c. Dissolve 2 ounces seed lac and 2 ounces white resin in 1 pint spirits of wine. This varnish or polish must be laid on warm, and if the work can be warmed also, it will be so much the better; at any rate, moisture and dampness must be avoided.

3008. How to Give Black Walnut a Dark Dead Smooth Surface. Take asphaltum, pulverize it, place it in a jar or bottle, pour over it about twice its bulk of turpentine or benzole, put it in a warm place, and shake it from time to time. When dissolved, strain it and apply it to the wood with a cloth or stiff brush. If it should make too dark a stain, thin it with turpentine or benzole. This will dry in a few hours. If it is desired to bring out the grain still more, apply a mixture of boiled oil and turpentine; this is better than oil alone. Put no oil with the asphaltum mixture, as it will dry very slowly. When the oil is dry the wood can be polished with the following: Shellac varnish, of the usual consistency, 2 parts; boiled oil, 1 part. Shake it well before using. Apply it to the wood by putting a few drops on a cloth and rubbing briskly on the wood for a few moments. This polish works well on old varnished furniture.

3009. Polish for Turners' Work. Dissolve sandarach in spirits of wine in the proportion of 1 ounce sandarach to ½ pint of spirits; next shave bees' wax, 1 ounce, and dissolve it in a sufficient quantity of spirits of turpentine to make it into a paste; add the former mixture by degrees to it; then with a woolen cloth apply it to the work while it is in motion in the lathe, and with a soft linen rag polish it. It will appear as if highly varnished.

To Enamel Wood-Work.

This is a process for creating an artificial, glossy surface of any color on wood, very durable, and highly ornamental. It consists of three distinct, successive operations; first, the colored coating or surface; next, the preparation of the surface for polishing; and finally, polishing.

3011. To Prepare the Filling-up Color for Enameling Wood. The filling-up color, which forms the body of the enamel, is of the greatest importance to the ultimate success of the work. Of this material there are several kinds manufactured—black, brown, and yellow, for coach painters, japanners, and others; but for use in interior decoration it is preferable to use the white lead filling, as, by adding the necessary staining colors (which do not affect the properties of the enamel), a solid body of color is formed, of the same tint, or nearly so, as that with which the work is required to be finished, thus doing away with the objections which may be urged against the black or dark-colored filling. It is evident that if work which has to be finished white, or with very light tints of color, be filled up with dark-colored filling, the number of coats of paint required to obscure or kill the dark color will be so many that there will be danger of the work becoming rough and uneven in parts. The white lead should be ground stiff in turpentine, and about one-fourth part of the ordinary white lead, ground in oil added to it, in order to prevent the enamel cracking, which it has a tendency to do, except there be some little oil mixed with it. A sufficient quantity of polishing copal or best carriage varnish should now be added to bind it so that it will rub down easily, which fact cannot be properly ascertained except by actual trial, inasmuch as the drying properties of varnishes vary, and other causes influence the matter. If there be too much varnish in the stuff the work will be exceedingly difficult to cut down, and if too little, it is apt to break up in rubbing, so that it is always the safest plan to try the enamel color before commencing anything important.

3012. To Lay the Color on Enameled Wood. The color, being properly mixed, should be laid on the work in the ordinary manner, using it rather freely. It may be as well to state here that no filling should be put upon new work without the same having had 2 or 3 coats of ordinary oil paint, nor on old work without its having one coat. This gives a foundation for the filling. Successive coats of the filling should now be laid on the work until there is a sufficient thickness to cut down to a level surface. One day should intervene between each coat, in order to allow it to harden in some degree. When a sufficient number of coats are put on (which number will, of course, depend upon the state of the work to be filled up), it should stand for 2 or 3 weeks, until it is thoroughly hard; it will then be ready for cutting down, which is to be done with a felt rubber, ground pumice stone, and water.

3013. To Prepare the Rubber for Enameling Wood. The felt used should be such as the sculptors use for polishing marble, which varies in thickness from ⅛ to ½ an inch, and about 3 inches square. This should be fastened with resinous gum to square pieces of wood of the same size, but 1 inch thick, so as to give a good hold for the hand in using. These pieces of wood, covered with felt, may be made of any size or shape to fit molded surfaces or other inequalities.

3014. To Prepare the Pumice Stone for Enameling Wood. The pumice stone to be used should be of different degrees of fineness, and should be carefully selected, so as to be sure that it is free from any gritty substance. It is sold ready ground, but in situations where it cannot be conveniently got, it may be prepared from the lump, by grinding or crushing with a stone and muller, and then passed through fine sieves or muslin; by using these of different degrees of texture the ground pumice may be produced of different degrees of fineness. Unless great care be exercised in this matter, it will be found that particles of grit will be mixed with it, which make deep scratches on the work, thus causing endless trouble and annoyance, besides spoiling the work. The greatest care is also required in keeping the felt clean and free from grit. Many workmen are careless in this matter, and, when working, set down the felt on the step-ladder or floor, thus allowing particles of sand or grit to get upon it.

3015. To Cut Down or Prepare the Surface for Polishing. In cutting down, it is best to use a piece of soft lump pumice stone to take off the rough parts. The work should then be wet with a sponge; the felt must first be soaked in water, then dipped into the powdered pumice, and the work rubbed with it, keeping it moderately wet, and rubbing with a circular motion, not straight up and down and across, and with a light touch, using only just as much pressure as will cause the pumice to bite, which will be very clearly felt while the hand is in motion. Care and patience are required to do this properly, for if the pressure be too great it forces the pumice into the body of the filling color, and scratches it instead of cutting or grinding it fairly down. No hurry will avail in doing this work, it must have its time; hurry only defeats the end in view, and often causes much unnecessary labor. A scratch, caused by want of care and too much haste, will often throw the work back for days, and involve the cost and labor of refilling. In practice the purpose is best answered by using the pumice stone, the coarser kind first, then the medium, and finishing with the finest last. It will be found advantageous to let a day elapse between the rubbing, for when the surface is cut down the filling will in all cases be softer underneath, and if it be allowed to stand for a day, the newly exposed surface gets harder, and of course rubs down better. The pumice stone should be well washed off the work occasionally, in order to see what progress is being made, and if it require more rubbing or not. If, after the first rubbing, the surface be found not sufficiently filled up, it may have one or more additional coats of filling before much labor has been spent upon it.

3016. To Polish the Filling. When sufficiently rubbed down with the pumice stone—that is to say, when it has been cut down to a fine, level, and uniform surface, (*see No.* 3015), the work should stand for a day or two to harden. It will now depend entirely upon the work, as to whether it must be polished upon the filling, or whether it will have to be varnished and polished. If the filling be of the right color, and of one uniform tint, it is best to be finished in this state, because it will have a surface and texture which cannot be got by any other means. Finished in this state it has all the uniformity of surface and evidence of finish, without that appearance of varnish which is so objectionable. After it has stood a day or two, the work must be polished in this way: Take a clean felt and rotten stone, either in oil or water, and with this rub the work as before, until the polish begins to appear; then take a boss (*i. e.* a ball of cotton wool inclosed in fine silk), put the rotten stone upon this and keep rubbing with the circular motion until the polish is uniform and equal all over. The rotten stone must now be carefully cleaned off; if it be in oil, clean off with fine flour; if in water, with sponge and wash-leather and water, taking care not to scratch. A clean damp chamois or wash-leather will now be required, which must be held in the left hand, leaving the right perfectly at liberty. Now use the ball of the right hand, press gently upon the panel, and draw it forwards or towards you. If this be done properly, it will bring up a clear polish upon the work. The hand should be kept slightly damp by drawing it across the leather almost every time the hand is drawn forward. If this be done effectually, a rustling sound will be produced while the hand is in motion; if this be so, the polish will be sure to follow. The polish thus produced on the filling alone will have a beautiful soft appearance; but if the work has to be finished with a brilliant lustre, and to a high degree of polish, proceed as follows:

3017. **To Finish Wood with a Brilliant Polish.** After being cut down with the pumice and felt as directed in No 3015, the filling has to be coated with two or more coats of the best polishing copal varnish, having a quantity of the best tube flake white; this should be mixed with the varnish in sufficient quantity to form a creamy mixture, with which the work must be coated—one, two, or three coats, as may be desirable. This should stand for 3 or 4 weeks, until it becomes hard; for the harder it is the better it will polish. It must then be cut down with felt and the finest ground pumice stone in water, and polished with the rotten stone, as before described. By this means a bright and brilliant polish may be obtained, of a very enduring nature. The same process will of course answer for all varnished imitations of woods and marbles, and all work which will admit of the application of oil varnishes.

Japanning is a kind of varnishing or lacquering, practiced in perfection by the Japanese, whence the name. The only difference between varnishing and japanning is that after the application of every coat of color or varnish, the object so varnished is placed in an oven or chamber called a stove, at as high a temperature as can safely be employed without injuring the articles or causing the varnish to blister or run.

3019. **To Prepare Metal for Japanning.** Metal requires no other preparation than cleaning with turpentine, to free it from grease or oil, unless the latter should happen to be linseed oil, in which case the cleaning is generally dispensed with, and the articles are placed in the stove and heated until the oil is baked quite hard.

3020. **To Prepare Wood for Japanning.** Wood that is intended to be used for the best japanned work, requires to be thoroughly dried before it is made up, otherwise it will be subject to all the evils of shrinking, warping, and splitting, when exposed to the heat of the stove. To avoid these evils, the wood, after having been well seasoned in the usual manner, by exposure to the air, is sawn out nearly to the required forms, and baked for several days in the japanner's stove, the heat of which is gradually increased; and the wood is afterwards worked up into chairs, tables, trays, and similar articles, which are afterwards again exposed to the heat of the stove, and any cracks or other imperfections, that may be thus rendered apparent, are carefully stopped with putty or white lead before the japanning is commenced.

3021. **To Prepare the Ground for Japanning.** For black japanned work, the ground is first prepared with a coating of black, made by mixing dross ivory black to a proper consistence with dark colored *anime* varnish, as this gives a blacker surface than could be produced by japan alone. If the surface is required to be polished, five or six coats of japan are necessary to give sufficient body to prevent the japan from being rubbed through in polishing.

3022. **To Make Black Japan Varnish.** Melt together 50 pounds Naples asphaltum and 8 pounds dark gum anime, and boil for 2 hours in 12 gallons linseed oil; then melt 10 pounds dark gum amber, and boil it with 2 gallons linseed oil; add this to the other, with a sufficient quantity of dryers, and boil for 2 hours longer, or until a little of the mass, when cooled, may be rolled into pills; then withdraw the heat, and afterwards thin down with 30 gallons oil of turpentine. This is excellent for either wood or metals.

3023. **Flexible Black Japan Varnish.** A good black japan is made of burnt umber, 4 ounces; true asphaltum, 2 ounces; and boiled oil, 2 quarts. Dissolve the asphaltum at first in a little oil, using a moderate heat; then add the umber, ground in oil, and lastly, the rest of the oil, and incorporate thoroughly. Thin with turpentine. It is a flexible japan, and may be used on metal work which requires to be bent somewhat.

3024. **Colored Japan.** For colored works no japan is used, but they are painted with ordinary painters' colors, ground with linseed oil or turpentine, and mixed with anime varnish; and the work is dried in the oven in the same manner as the black japan. To protect the colors, and give brilliancy and durability to the surface, the work is afterwards varnished with copal or anime varnish, made without dryers. 2 or 3 coats of varnish suffice for ordinary works, and 5 or 6 for the best works that are polished. Very pale varnish is of course required for light colors. Ornamental devices are painted on the objects in the usual manner, after the general color of the ground has been laid on. The colors are dried in the stove, and the work is finally varnished and polished just the same as plain colors, but more carefully.

3025. **Transparent Japan Varnish.** Oil turpentine, 8 ounces; oil lavender, 6 ounces; camphor, 1 drachm; bruised copal, 2 ounces; dissolve. Used for tin, &c. Quick drying copal varnish is usually substituted.

3026. **To Color Japan Varnish.** The above is a transparent japan, but by the following modifications any or all of the various colors may be made from it. It is indispensable that the colors be ground to an impalpable powder before mixing with the varnish, and should then be thoroughly ground with the varnish, otherwise it is preferable to apply the color first as a paint, and varnish afterwards with the above transparent japan. Previous to varnishing a painted surface, it should be cut down with pulverized pumice-stone, &c., as directed in No. 1486.

3027. To Color Japan Blue. Indigo and Prussian blue, both finely pulverized, of each ½ ounce; spirits of turpentine, 1 pint. Mix well and strain. Or use verditer glazed with Prussian blue or smalt; mix with the varnish in No. 3025.

3028. To Color Japan Red. Vermilion makes a fine scarlet, but its appearance in japanned work is much improved by glazing it with a thin coat of lake, or even rose pink. Or: Take spirits of turpentine, ½ pint; add cochineal, ½ ounce; let stand 15 hours, and strain. Add to the transparent varnish (*see No.* 3025) to suit the fancy.

3029. To Color Japan Yellow. King's yellow, turpeth mineral (subsulphate of mercury), and Dutch pink, all form very bright yellows, and the latter is very cheap. Seed lac varnish assimilates with yellow very well; and when they are required very bright, an improvement may be effected by infusing turmeric in the varnish which covers the ground. Or: Take 1 ounce of pulverized root of curcuma and stir of it into 1 pint of the transparent varnish (*see No.* 3025) until the color pleases you; let stand a few hours, and strain.

3030 To Color Japan Green. Distilled verdigris laid on a ground of leaf gold produces the brightest of all greens; other greens may be formed by mixing King's yellow and bright Prussian blue, or turpeth mineral and Prussian blue, or Dutch pink and verdigris. Mix with varnish. (*See Nos.* 3025 *and* 1421.)

3031. To Color Japan Orange. Mix a *little* red with yellow until the desired color is obtained; and add to transparent japan. (*See No.* 3025.)

3032. To Color Japan White. White grounds are obtained with greater difficulty than any other. One of the best is prepared by grinding up flock-white, or zinc-white, with ⅙ of its weight of starch, and drying it; it is then tempered, like the other colors, using the mastich varnish for common uses; and that of the best copal for the finest.

3033. To Color Japan Pink. Mix sufficient red (*see No.* 2028) with transparent varnish (*see No.* 3025) to give the desired tint of pink.

3034. To Color Japan Purple. Mix red and blue together, and add to the varnish. (*See No.* 3025.)

3035. To Color Japan Violet. A violet japan may be obtained by mixing purple (*see No.* 3034), and white (*see No.* 3032), with transparent japan (*see No.* 3025.)

3036. To Color Japan Brown. For brown japanned works, the clear japan alone is used as the ground, or umber is mixed with the japan to give the required tint, and the work is afterwards dried in the oven, in the same manner as black japan.

3037. To Japan Old Tea-Trays. First clean them thoroughly with soap and water and a little rotten-stone; then dry them by wiping and exposure at the fire. Now get some good copal varnish, mix with it some bronze powder, and apply with a brush to the denuded parts, after which set the tea-tray in an oven, at a heat of 212° to 300°, until the varnish is dry. Two coats will make it equal to new.

India Japanning. The great peculiarity in the Indian method is the embossing, or raising the figures, &c., above the surface or ground, and the metallic or bronze-like hue of the several designs; the grotesque appearance of the several ornaments, whether figures, landscapes, or whatever other designs they are embellished with, being so totally different from every principle of perspective, and so opposite to every idea we have of correct drawing. Nothing but the study of Chinese models themselves will enable the workmen to imitate, with any degree of precision, their several characteristics.

3039. Ground for Chinese Japan. Mix any quantity of the finest whiting to the consistency of paint, with isinglass size; lay on your wood 2 or 3 coats, observing to put it on evenly and smoothly, and not too thick; let it dry; then rub it gently with a soft rag and water till the surface is quite level and polished; if a small portion of honey is added to the mixture, it will render it less liable to crack or peel off. If the ground is to be black, which is most usual, give it a coat or two of the black japan mentioned in the common method of japanning (*see No.* 3022), and it is prepared for the figures, &c.

3040. Plaster Ground for Chinese Japan. Mix fine plaster of Paris with size not too thick, and apply it quickly, for it soon gets hard. Two coats, in most instances, will be sufficient. After it is quite dry, polish it with fine glass paper, and rub it with a wet soft cloth; then give it 2 or 3 coats of drying linseed oil, or as much as it will soak up. When dry, it is ready for japanning.

3041. To Trace Designs on the Ground. Having drawn the figures on a piece of white paper either with ink or pencil, rub the back of it with fine chalk or whiting, and shake all the loose powder off; lay it on the ground, and trace or go over every part of the outline with the end of a blunt bodkin, or other similar instrument; you will then have a sketch in faint outline on your ground. Then proceed to put in the figures, &c., with any desired color, or bronze them.

3042. To Raise Figures on the Work. Prepare a mixture of whiting and size (some prefer the whites of eggs), of a consistency to flow freely from the pencil, the hairs of which must be rather long. Begin with a figure, or other part—but do not do too much at a time—and trace the outline correctly, with a free hand; then take a piece of stick pointed at the end, dip it into the composition, and fill up the inside of the outline. Continue to put more of the mixture on till it is raised sufficiently above the surface. Let it get quite dry, and then polish it with a small camel's-hair pencil and clean water, so as to make it perfectly smooth and level. Care must be taken in this process, that the composition is not too thin, or it will spread beyond the bounds of the outline, but just so thick as to drop from the stick. Some mix with the whiting a portion of flake-white, or dry white-lead. This is an improvement, and for very particular work should be adopted.

3043. To Japan Work-Boxes and Fancy Articles. There is a very pretty method of ornamenting boxes, cabinets, &c.,

so that the figures appear of the color of the wood, and the ground black or colored; this, by many, is produced by first tracing out the pattern, and then pricking in those parts which shall appear as the ground, either black or any color at fancy. This is a very tedious process, and even when finished with the greatest care, will not appear regular or well defined in the pattern. The following method will be found very expeditious, and at the same time very correct; it is but little known, and, as such, will to the practical japanner be the more acceptable. It may also be applied to many other purposes than here alluded to. The following preparation is necessary, and may be termed the stopping out mixture; it is made by dissolving the best white bees' wax in spirits of turpentine till it is of the consistency of varnish. Keep this mixture in a bottle, and, when wanted for use, mix sufficient for your present purpose with white lead in powder, or flake white, to give it a body—but not too thick, only so that it will flow freely from the brush. Having traced the design, go over those parts which are to remain of the color of the wood, and let it dry; then mix ivory-black (or other color as may be required), in very fine powder, with parchment or isinglass size, and go evenly and smoothly over every part of the work. It will now appear wholly black, or of whatever color that was mixed with the size. Let the whole get thoroughly dry; then, with a stiff brush dipped in plain spirits of turpentine, rub the whole of the work well, and those parts that have been gone over with the stopping-out mixture, will come off, leaving the black or other color perfect. It will then appear as if the work had been pricked in, but much sharper, and will, if carefully done, have a beautiful effect. You have now nothing more to do than varnish the work, as usual, and polish it as directed in Nos. 2979, &c. To finish the work in the manner of Indian japan, give it 8 or 10 coats of varnish, so that it will bear polishing.

3044. Sealing-Wax Varnish. For fancy work, this has of late years been much used, and, if well applied and the wax good, will be a very good imitation of India japan. The method of making the varnish or japan is very easy, being simply reducing the wax to a coarse powder, and pouring the best spirits of wine on it in a bottle, and letting it gradually dissolve without heat, shaking the bottle occasionally till it is all dissolved. A 2 ounce stick of the best wax will be enough for ¼ pint of spirits. Much depends on the goodness of the sealing-wax, and the color of the varnish may be varied by using differently colored wax. The finest vermilion sealing-wax makes the best varnish, the other colors not flowing quite as well; white sealing-wax is very apt to clot when drying. As this varnish dries very quickly, it should not be made until it is wanted for use.

Lacquers.

Lacquers are used upon polished metals and wood to impart the appearance of gold. As they are wanted of different depths and shades of color, it is best to keep a concentrated solution of each coloring ingredient ready, so that it may at any time be added to produce any desired tint. Lacquer should always stand till it is quite fine, before it is used.

3046. To Lacquer Brass Work. If the work is old, clean it first, according to the directions hereafter given; but if new, it will merely require to be freed from dust, and rubbed with a piece of wash-leather, to make it as bright as possible. Put the work on a hot iron plate (or upon the top of the stove), till it is moderately heated, but not too hot, or it will blister the lacquer; then, according to the color desired, take of the following preparations, and, making it warm, lay hold of the work with a pair of pincers or pliers, and with a soft brush apply the lacquer, being careful not to rub it on, but stroke the brush gently one way, and place the work on the hot plate again till the varnish is hard; but do not let it remain too long. Experience will best tell you when it should be removed. Some, indeed, do not place it on the stove or plate a second time. If it should not be quite covered, you may repeat it carefully; and, if pains be taken with the lacquer, it will look equal to metal gilt.

3047. To Clean Old Brass Work for Lacquering. Make a strong lye of wood-ashes, which may be strengthened by soap-lees; put in the brass-work, and the lacquer will soon come off; then have ready a mixture of aquafortis and water, sufficiently strong to take off the dirt; wash it afterwards in clean water, and lacquer it with such of the following compositions as may be most suitable to the work.

3048. To Make Gold Lacquer for Brass. Rectified spirits of wine, ½ pint; mix ½ pound of seed-lac, picked clean, and clear of all pieces (as upon that depends the beauty of the lacquer) with the spirits of wine; keep them in a warm place, and shake them repeatedly. When the seed-lac is quite dissolved, it is fit for use.

3049. Gold Lacquer. Put into a clean four gallon tin, 1 pound ground turmeric, 1½ ounces powdered gamboge, 3½ ounces powdered gum-sandarach, ¾ pound shellac, and 2 gallons spirits of wine. After being agitated, dissolved, and strained, add 1 pint of turpentine varnish, well mixed.

3050. Gold Colored Lacquer for Watch Keys, Etc. Seed-lac, 6 ounces; amber, 2 ounces; gamboge, 2 ounces; extract of red sandal wood in water, 24 grains; dragon's blood, 60 grains; oriental saffron, 36 grains; pounded glass, 4 ounces; pure alcohol, 36 ounces. The seed-lac, amber, gamboge, and dragon's blood must be pounded very fine on porphyry or clean marble, and mixed with the pounded glass. Over this mixture is poured the tincture formed by infusing the saffron and the extract of sandal wood in the alcohol for 24 hours. Metal articles that are to be covered with this varnish are heated, and, if they are of a kind to admit of it, are immersed in packets. The tint of the varnish may be varied in any degree required, by altering the proportions of the coloring quantities according to circumstances.

3051. Deep Gold Lacquer. Seed-lac, 3 ounces; turmeric, 1 ounce; dragon's blood, ¼ ounce; alcohol, 1 pint. Digest for a week, frequently shaking, decant and filter. Deep gold colored.

3052. Dark Gold Colored Lacquer. Strongest alcohol, 4 ounces; Spanish annotto, 8 grains; powdered turmeric, 2 drachms; red saunders, 12 grains. Infuse and add shellac, etc., as to the pale tin lacquer (*see No.* 3058), and when dissolved add 30 drops of spirits of turpentine.

3053. Gold Lacquer. Ground turmeric, 1 pound; gamboge, 1½ ounces; gum sandarach, 3½ pounds; shellac ¾ pound; all in powder; rectified spirit of wine, 2 gallons. Dissolve, strain, and add turpentine varnish, 1 pint.

3054. Brass Lacquer. Take 8 ounces shellac, 2 ounces sandarach, 2 ounces annotto, ¼ ounce dragon's blood resin, 1 gallon of spirits of wine. The article to be lacquered should be heated slightly, and the lacquer applied by means of a soft camel's-hair brush.

3055. Pale Brass Lacquer. Take 2 gallons spirits of wine, 3 ounces cape aloes cut small, 1 pound fine pale shellac, 1 ounce gamboge cut small. Digest for a week, shake frequently, decant and filter.

3056. Lacquer for Bronzed Dipped Work. A lacquer for bronzed dipped work may be made thus: Alcohol, 12 gallons; seed-lac, 9 pounds; turmeric, 1 pound to the gallon; Spanish saffron, 4 ounces. The saffron may be omitted if the lacquer is to be very light.

3057. Lacquer for Tin Plate. Best alcohol, 8 ounces; turmeric, 4 drachms; hay saffron, 2 scruples; dragon's blood, 4 scruples; red saunders, 1 scruple; shellac, 1 ounce; gum sandarach, 2 drachms; gum mastich, 2 drachms; Canada balsam, 2 drachms; when dissolved, add spirits of turpentine, 80 drops.

3058. Pale Tin Lacquer. Strongest alcohol, 4 ounces; powdered turmeric, 2 drachms; hay saffron, 1 scruple; dragon's blood in powder, 2 scruples; red sanders, ½ scruple. Infuse this mixture in the cold for 48 hours, pour off the clear, and strain the rest; then add powdered shellac, ½ ounce; sandarach, 1 drachm; mastich, 1 drachm; Canada balsam, 1 drachm. Dissolve this in the cold by frequent agitation, laying the bottle on its side, to present a greater surface to the alcohol. When dissolved, add 40 drops of spirits of turpentine.

3059. Iron Lacquer. Take 12 parts amber, 12 parts turpentine, 2 parts resin, 2 parts asphaltum, 6 parts drying oil. Or, 3 pounds asphaltum, ½ pound shellac, 1 gallon turpentine.

3060. Red Lacquer. Take 2 gallons spirits of wine, 1 pound dragon's blood, 3 pounds Spanish annotto, 4¼ pounds gum sandarach, 2 pints turpentine. Made as pale brass lacquer.

3061. Red Lacquer. Spanish annotto, 3 pounds; dragon's blood, 1 pound; gum sandarach, 3¼ pounds; rectified spirit, 2 gallons; turpentine varnish, 1 quart. Dissolve and mix as the last.

3062. Lacquer for Philosophical Instruments. Gamboge, 1½ ounces; gum sandarach, 4 ounces; gum elemi, 4 ounces; best dragon's blood, 2 ounces; terra merita, 1½ ounces; oriental saffron, 4 grains; seed-lac, 2 ounces; pounded glass, 6 ounces; pure alcohol, forty ounces. The dragon's blood, gum elemi, seed-lac, and gamboge, are all pounded and mixed with the glass. Over them is poured the tincture obtained by infusing the saffron and terra merita in the alcohol for 24 hours. This tincture, before being poured over the dragon's blood, etc., should be strained through a piece of clean linen cloth, and strongly squeezed. If the dragon's blood gives too high a color, the quantity may be lessened according to circumstances. The same is the case with the other coloring matters. In choosing the terra merita, select that which is sound and compact. This lacquer has a very good effect when applied to many cast or moulded articles used in ornamenting furniture, the irregularity of surface of which would render it difficult, if not impossible, to polish in the ordinary manner.

3063. To Make Lacquer of Various Tints. Put 4 ounces best gum gamboge into 32 ounces spirits of turpentine; 4 ounces dragon's blood into the same quantity of spirits of turpentine as the gamboge, and 1 ounce annotto into 8 ounces of the same spirits. The 3 mixtures should be made in different vessels. They should then be kept for about two weeks in a warm place, and as much exposed to the sun as possible. At the end of that time they will be fit for use; and any desired tints may be obtained by making a composition from them, with such proportions of each liquor as the nature of the color desired will point out.

3064. Durable and Lustrous Black Coating for Metals. The bottom of a cylindrical iron pot, which should be about 18 inches in height, is covered half an inch with powdered bituminous coal; a grate is then put in and the pot filled with the articles to be varnished. Articles of cast iron, iron wire, brass, zinc, steel, tinned iron, &c., may be subjected to the same treatment. The cover is then put on and the pot heated over a coke fire under a well-drawing chimney. In the beginning the moisture only evaporates, but soon the coking commences, and deep brown vapors escape, which irritate the throat. When the bottom of the pot has been heated for 15 minutes to a dull red heat, the coal has been mostly converted into coke; the pot is then removed from the fire, and after standing 10 minutes opened for evaporation, all the articles will be found covered with the above described coating. This lacquer is not only a protection against oxidation of metals, but will stand also a considerable heat, only disappearing at beginning redness, and therefore its useful application for ovens and furnaces. The coating produced is thin, lustrous, and cannot easily be scratched. Fine iron ware articles, such as sieves, are in this manner coated with remarkable evenness, which cannot be accomplished in any other way. Articles made of tin, or soldered, cannot be subjected to this process, as they would fuse. Smaller articles, like hooks and eyes, receive this coating by heating them together with small pieces of bituminous coal in a cylindrical sheet iron drum like that used for roasting coffee, until they present the desired lustrous black appearance.

Preservation of Leather.

The extreme heat to which most men and women expose boots and shoes during winter deprives leather of its vitality, rendering it liable to break and crack. Patent leather particularly is often destroyed in this manner. When leather becomes so warm as to give off the smell of leather, it is singed. Next to the singeing caused by fire heat, is the heat and dampness caused by the covering of rubber. Close rubber shoes destroy the strength of leather. The practice of washing harness in warm water and with soap is very damaging. If a coat of oil is put on immediately after washing, the damage is repaired. No harness is ever so soiled that a damp sponge will not remove the dirt; but, even when the sponge is applied, it is always useful to add a slight coat of oil by the use of another sponge. All varnishes, and all blacking containing the properties of varnish should be avoided. Ignorant and indolent hostlers are apt to use such substances on their harness as will give the most immediate effect, and these, as a general thing, are most destructive to the leather.

3066. To Restore the Lustre of Leather. When harness loses its lustre and turns brown, which almost any leather will do after long exposure to the air, the harness should be given a new coat of grain black. Before using this grain black, the grain surface should be well washed with potash water until all the grease is killed, and after the application of the grain black, oil and tallow should be applied to the surface. This will not only fasten the color, but make the leather flexible. Harness which is grained can be cleaned with kerosene or spirits of turpentine.

3067. To Restore Softness to Leather. To restore the softness and pliancy of leather which has become hard by having been wet, apply neat's foot oil and rub it in. Castor oil is a good substitute for neat's foot oil for softening leather belts, boots and harness. But the best oil for harness, is 1 quart neat's foot oli, 4 ounces beef's tallow, and 3 table-spoonfuls lampblack; add 4 ounces bees' wax for use in summer weather.

3068. To Restore the Lustre of Morocco. The lustre of Morocco is restored by a varnishing with the white of an egg. Apply with a sponge.

3069. To Make Boots Waterproof. Beef tallow, 4 ounces; resin, 1 ounce; bees' wax, 1 ounce; melt together. Add, when cold, a quantity of neat's foot oil equal to the mass. Apply with a rag, warming the boots before a fire, to the soles as well as uppers, and rub in well with the hand. Two applications will make the boots thoroughly waterproof and still keep them soft. We, however, do not approve of such preparations, as the feet generally perspire more than any other portions of the body, and any waterproof preparations applied to boots prevent the perspiration from escaping, and keep the feet wet and cold. The New England fishermen preserve their boots waterproof by this method, which, it is said, has been in use among them above 100 years.

3070. To Make Boots Water-Tight. In a pint of best winter-strained lard oil, dissolve a piece of paraffine the size of a hickory nut, aiding the solution with a gentle heat, say 130° or 140° Fahr. The readiest way to get pure paraffine is to take a piece of paraffine candle. Rub this solution on your boots about once a month; they can be blacked in the meantime. If the oil should make the leather too stiff, decrease the proportion of paraffine, and vice versa. A gentleman who has tried this says:—I have used this for 8 years past, and boots have lasted me two winters, the uppers always remaining soft, and never cracking. I have tried bees' wax, resin, tar, etc., but never found any other preparation half so good.

3071. Sportsmen's Waterproof Composition for Boots. Dissolve by heat 1 ounce pure bottle India-rubber shavings in 1 quart neat's foot oil, and add 2 ounces tallow. This makes a fine waterproof composition for boots, and is recommended to sportsmen.

3072. Polish for Patent Leather Goods. Take ½ pound molasses or sugar, 1 ounce gum-arabic, and 2 pounds ivory black; boil them well together, then let the vessel stand until quite cooled, and the contents are settled; after which, bottle off. This is an excellent reviver, and may be used as a blacking in the ordinary way, no brushes for polishing being required.

3073. Glycerine Composition for Leather. As is well known, glycerine has found extensive application in tanning, as it has been discovered that it adds materially to the elasticity and strength of the leather. Especially has it been found of great value in protecting leather bands of machinery from cracking and drying. The partially tanned leather is immersed for considerable time in a bath of glycerine, by which the pores are filled and such an elasticity and softness is imparted that objects manufactured from it are much less liable to break. In order to prepare a neutral gutta-percha composition with glycerine, take 3 to 4 pounds lampblack, ½ pound burnt bones (burnt ivory), cover up in a suitable vessel with 5 pounds glycerine and 5 pounds common syrup, and stir well until the whole is intimately mixed and free from lumps. 4 or 5 ounces of gutta-percha, finely cut, are to be put into a kettle, and after melting must be mixed with 20 ounces of sweet oil and dissolved, and 2 ounces of stearine added. While still warm the gutta-percha solution must be incorporated with the syrup and lampblack, and after this is done, 10 ounces of Senegal gum dissolved in 1½ pounds of water is also added. In order to impart an agreeable odor to the mass a small quantity of rosemary or lavender oil may be introduced. In using, the glycerine gutta-percha paste must be diluted with 3 or 4 parts of water. It gives a fine lustre, and, as it contains no acid, it does not injure the leather, but makes it soft and elastic and adds very much to its durability.

3074. To Preserve and Clean Harness. In the first place, subject the harness to 1 or 2 coats (as the leather may need) of lampblack and castor oil, warmed sufficiently to make it penetrate the leather readily. Then make about 2 quarts of warm soap-suds, and with a sponge wash the harness. When dry, rub it over with a mixture of oil and tallow, equal parts, with sufficient lampblack to give it color; or, what is better, Prussian blue, which gives it a new and fresh look. This compound should be applied sparingly and well rubbed in, which can be quickly done and will leave a smooth and clean surface.

3075. Harness Polish. Take 2 ounces mutton suet, 6 ounces bees' wax, 6 ounces powdered sugar candy, 2 ounces soft soap, and 1 ounce indigo or lampblack. Dissolve the soap in ½ pint of water; then add the other ingredients; melt and mix together; add a gill of turpentine. Lay it on the harness with a sponge, and polish off with a brush.

3076. To Clean Leather. Uncolored leather may be cleaned by applying a solution of oxalic acid with a sponge. Dissolve in warm water.

3077. To Take Oil Out of Leather. Use strong (F. F. F. F.) aqua ammonia, which will take oil out without injury to the leather. It must be used 2 or 3 times in order to get it all out. First use it and let the leather stand until more comes out, and apply again. This is the only thing that will take it out and not hurt the leather.

3078. Dubbing for Leather. Mix 2 pounds black resin, 1 pound tallow with 1 gallon train oil.

3079. Jet for Harness and Boots. Dissolve 3 sticks of the best black sealing-wax in ½ pint spirits of wine; keep in a glass bottle, and shake well previous to use. Applied with a soft sponge. This gives the leather a fine black surface, which, however, is apt to crack more or less.

3080. Shoemakers' Black. A solution of green copperas (sulphate of iron) in about 12 times its weight in water. It is used to black leather which has been tanned with bark or other astringent matter, and to the edges of the soles etc., with a feather or brush.

3081. Harness Liquid Blacking. Dissolve by heat, 4 ounces glue or gelatine and 3 ounces gum arabic in ¾ pint water; add 7 ounces molasses and 5 ounces ivory black in very fine powder; gently evaporate until of a proper consistence when cold, stirring all the time. Keep in corked bottles.

3082. Harness Waterproof Paste Blacking. Melt together 2 ounces mutton suet and 6 ounces bees' wax; add 6 ounces sugar candy, 2 ounces soft soap, 2½ ounces lampblack, and ½ ounce indigo in fine powder; when thoroughly mixed add ¼ pint of oil of turpentine; put into pots or tins.

3083. Harness Waterproof Cake Blacking. Melt 1 pound bees' wax, 1 ounce Prussian blue ground in 2 ounces linseed oil, ¼ pound ivory black, 3 ounces oil of turpentine and 1 ounce copal varnish; mix well together and form into cakes whilst warm.

3084. Harness Waterproof Blacking. Mix the same ingredients as in the last receipt, and while hot add 4 ounces soft soap and 6 ounces more oil of turpentine; put the paste into pots or tins. None of the above blackings will injure the leather.

3085. To Apply Harness Blacking. Spread a very little of the blacking evenly on the surface of the leather, and polish by gentle friction with a brush or an old handkerchief. Paste blacking is thinned with water.

Boot and Shoe Blacking.

The manipulations required for paste and liquid blacking are the same, the difference in the two being the quantity of liquid added. Thus, by diluting paste blacking with water or beer bottoms, it may be converted into liquid blacking of a similar quality, and, by using less fluid matter, the ingredients of liquid blacking will produce paste blacking. One thing must, however, be observed, and that is, that the ivory-black used for liquid blacking must be reduced to a much finer powder than for paste blacking, as, if this be not attended too, it will settle to the bottom, and be with difficulty diffused again through the liquid. For those persons who do not like the use of blacking containing oil of vitriol, the first of the forms given below, either for paste or liquid, may be adopted. The vitriol, however, greatly contributes to promote the shining properties of the blacking, and in small quantities is not so injurious to the leather as has been falsely represented, as it wholly unites itself to the lime of the phosphate contained in the ivory-black, and is thus partly neutralized. This is the reason why lampblack should never be employed for blacking, as it has no earthy base to absorb or neutralize the acid, which would then prove very hurtful to the leather. Oil of vitriol is now employed in the manufacture of all the most celebrated shining blackings. The addition of white of eggs, isinglass, gum-arabic, and similar articles to blacking, always proves injurious, as they tend to stiffen the leather and to make it crack.

3087. Liquid Blacking. Ivory-black, in fine powder, 1 pound; molasses, ¾ pound; sweet oil, 2 ounces; beer and vinegar, of each 1 pint. Rub together the first three until the oil be perfectly killed, then add the beer and vinegar.

3088. Fine Liquid Blacking. Ivory-black and molasses, of each 1 pound; sweet oil and oil of vitriol, of each ¼ pound. Mix the first three as before, then gradually add the vitriol, diluted with thrice its weight of water; mix well, and let it stand for 3 hours, when it may be reduced to a proper consistence with water or sour beer.

3089. Liquid Jet Blacking. Ivory-black and molasses, of each ¼ pound; oil of vitriol, 1 ounce; sweet oil, 2 ounces; sour beer, 1 pint; finish as last receipt.

3090. Good Liquid Blacking. Ivory-black, 7 pounds; molasses, 6 pounds; sweet oil, 1 pound; oil of vitriol, ½ pound; sufficient water; finish as in No. 3088.

3091. Liquid Blacking. Ivory-black, 3 cwt.; crude molasses, 2 cwt.; linseed oil, 3 gallons; oil of vitriol, 20 pounds; sufficient water to finish as in No. 3088.

3092. Bryant and James' Patent Liquid Blacking. 18 ounces caoutchouc are to be dissolved in about 9 pounds hot rape oil. To this solution 60 pounds of fine ivory-black and 45 pounds molasses are to be added, along with 1 pound finely-ground gum-arabic, previously dissolved in 20 gallons vinegar. These mixed ingredients are to be finely triturated in a paint-mill till the mixture becomes perfectly smooth. To this varnish 12 pounds sulphuric acid are to be now added in small successive quantities, with powerful stirring for half an hour; at the end of which time 3 pounds of finely-ground gum-arabic are added; after which the stirring is repeated half an hour every day for 14 days longer, when the liquid blacking is ready for use.

3093. Paste Blacking. Molasses, 1 pound; ivory-black, 1¼ pounds; sweet oil, 2 ounces; rub together as before (*see No.* 3088); then add a little lemon juice or strong vinegar.

3094. Brilliant Paste Blacking. Ivory-black, 2 pounds; molasses, 1 pound; olive oil and oil of vitriol, of each ½ pound; sufficient water, as before.

3095. Fine Paste Blacking. Ivory-black, 28 pounds; molasses, 21 pounds; common oil, 1 quart; oil of vitriol, 3 pounds; sufficient water, as before.

3096. Fine Oil Paste Blacking. Ivory-black, 3 cwt.; common molasses, 2 cwt.; linseed oil and vinegar bottoms, of each 3 gallons; oil of vitriol, 28 pounds; sufficient water, mix as before.

3097. Oil Paste Blacking. Ivory-black, 2 pounds; molasses, 4 or 5 ounces; oil of vitriol, 2 ounces; tanners' oil, 5 ounces (if this cannot be obtained, then use 4 ounces best tallow); gum-arabic, 1 ounce. Mix the oil and vitriol together, and let it stand 24 hours; dissolve the gum in a cupful of warm water; then add 3 table-spoonfuls of best vinegar; heat it and mix with the oil, &c., and then add the ivory-black, molasses, and white of 2 eggs.

3098. Real Japan Paste Blacking. Take 3 ounces ivory-black, 2 ounces coarse sugar, 1 ounce sulphuric acid, 1 ounce muriatic acid, 1 lemon, 1 table-spoonful sweet oil, and 1 pint vinegar. First mix the ivory-black and sweet oil together, then the lemon and sugar, with a little vinegar to qualify the blacking; then add the sulphuric and muriatic acids, and mix them all well together. The sugar, oil, and vinegar, prevent the acids from injuring the leather, and add to the lustre of the blacking.

3099. Bryant and James' Patent Paste Blacking. In making the paste blacking, the patentees prescribe the same quantity of India-rubber oil, ivory-black, molasses, and gum-arabic as in their liquid blacking, the latter being dissolved in only 12 pounds vinegar. These ingredients are to be well mixed, and then ground together in a mill till they form a perfectly smooth paste. To this paste 12 pounds sulphuric acid are to be added in small quantities at a time, with powerful stirring, which is to be continued ½ hour after the last portion of the acid has been introduced. Ready for use in 7 days.

3100. New Blacking. The lustrous qualities of blacking are frequently derived from ingredients which are most deleterious and destructive to leather. Herr Artus publishes a new formula, and claims several advantages for it, to which we may add its cheapness and accessibility. 3 or 4 pounds vegetable black, 1½ pounds ivory-black, 5 pounds molasses, and 5 pounds glycerine, mixed thoroughly together. 6 ounces gutta-percha, cut in small pieces, are then melted, and when fluid, 20 ounces olive oil are added, and subsequently, 2 ounces stearine. The second mixture, while quite hot, is stirred into the first; and then a further addition of 10 ounces gum Senegal, dissolved in about 3 quarts water, is added. This compound is the stock; for use, it should be diluted with about 3 times its quantity of warm water.

3101. Day and Martin's Blacking. According to Mr. W. C. Day, the method of making the famous "Day and Martin's Blacking" is as follows: Bone-black in a state of powder, is mixed with sperm oil until the two are thoroughly incorporated. Sugar or molasses is then mixed with a small portion of vinegar and added to the mass. Oil of vitriol is next added, and when all effervescence has ceased, more vinegar is poured in until the mixture is of a proper consistency. This constitutes the liquid blacking of the above-named manufacturers.

Method of Marbling Books.

This is performed by laying the color on the edges with a brush, or by means of a wooden trough and gum-water as follows:—Provide a wooden trough, 2 inches deep, 6 inches wide, and the length of a super-royal sheet; boil in a brass or copper pan any quantity of linseed and water until a thick mucilage is formed; strain it into the trough, and let it cool; then grind on a marble slab any of the following colors in small beer. For—

Blue, Prussian blue or indigo.

Red, rose-pink, vermilion, or drop lake.

Yellow, King's yellow, yellow ochre, &c.

White, flake white.

Black, ivory or burnt lampblack.

Brown, umber, burnt umber, vandyke brown, sienna, burnt sienna; black mixed with yellow and red, also makes brown.

Green, blue and yellow mixed.

Orange, red and yellow mixed.

Purple, red and blue mixed.

For each color you must have two cups, one for the color after grinding, the other to mix it with ox-gall, which must be used to thin the colors at discretion. If too much gall is used, the color will spread; when they keep their place on the surface of the trough, when moved with a quill, they are fit for use. All things being in readiness, the colors are successively sprinkled on the surface of the mucilage in the trough with a brush, and are waved or drawn about with a quill or stick, according to taste. When the design is thus formed, the book, tied tightly between cutting-boards of the same size, is lightly pressed with its edge on the surface of the liquid pattern, and then withdrawn and dried; the covers may be marbled in the same way, only letting the liquid colors run over them. The film of color in the trough may be as thin as possible, and if any remains after the marbling, it may be taken off by applying paper to it before you prepare for marbling again.

3103. Blue Sprinkle for Bookbinders. Strong sulphuric acid, 8 ounces; Spanish indigo, powdered, 2 ounces. Mix in a bottle that will hold a quart, and place it in a water-bath to promote solution. For use, dilute a little to the required color in a teacup.

3104. Blue Marble for Books, &c. Color the edges with King's yellow, and when dry tie the book between boards. Throw on blue spots in the gum trough, wave them with the iron pin, and apply the edges thereon.

3105. Brown Color for Marbling or Sprinkling Books. Logwood chips, 1 part; annotto, 1 part; boil in water, 6 parts. If too light, add a piece of copperas about the size of a pea. Or: Umber, any quantity. Grind it on a slab with ox-gall and a little lamp-black. Dilute with ale.

3106. Gold Sprinkle for Books. Put into a marble mortar ½ ounce pure honey and 1 book of gold leaf; rub them well together until they are very fine, add ½ pint of clear water, and mix them well together. When the water clears, pour it off, and put in more, till the honey is all extracted, and nothing remains but the gold. Mix 1 grain corrosive sublimate in a tea-spoonful spirits of wine, and when dissolved, put the same, together with a little gum water, to the gold, and bottle it close for use. The edges of the book may be sprinkled or colored very dark, with green, blue, or purple, and lastly with the gold liquid, in small or large spots, very regular, shaking the bottle before using. Burnish the edges when dry, and cover them with paper to prevent the dust falling thereon. This sprinkle will have a most beautiful appearance on extra work; ladies may use it for ornamenting their fancy work, by putting it on with a pen or camel's hair brush, and when dry burnishing it with a dog's tooth.

3107. Marble for Leather Book-Covers. Wash the cover and glair it, take a sponge charged with water, having the book between wands, and drop the water from the sponge on the different parts of the cover; sprinkle very fine with vinegar black, then with brown, and lastly with vitriol water. Observe to sprinkle on the colors immediately after each other, and to wash the cover over with a clean sponge and water.

3108. Chinese Edge for Books. Color the edge with light liquid blue and dry; then take a sponge charged with vermilion, and dab on spots according to fancy; next throw on rice, and finish the edge with dark liquid blue. Color light blue on different parts of the edge with a sponge; do the same where there are vacancies with yellow and Brazil red; dry and dab on a little vermilion in spots; then throw on rice, and finish with a bold sprinkle of dark blue. Burnish.

3109. Wax Marble for Leather Book-Covers, &c. This marbling must be done on the fore edge, before the back of the book is rounded, or becomes round, when in boards, and finished on the head and foot. Take bees' wax and dissolve it over the fire in an earthen vessel; take quills stripped of their feathers, and tie them together; dip the quill-tops in the wax, and spot the edge, with large and small spots; take a sponge charged with blue, green, or red, and smear over the edge: when done, dash off the wax, and it will be marbled. This will be useful for stationery work, or for folios and quartos.

3110. Yellow Egyptian Marble for Leather Book-Covers. Boil quercitron bark with water and a little powdered alum, over a slow fire, until it is a good strong yellow. Pour the liquid into a broad vessel, sufficiently large to contain the cover when extended. Before the liquid is cool, take the dry cover, and lay the grain side flat on the color; press it lightly that the whole may receive the liquid; let it soak some time, and then take it from the vessel. The book must be covered in the usual manner, and permitted to dry from the fire. Glair the book; when dry, place it between the wands; take a sponge and water, and press large spots thereon; dip a quill-top into the vinegar black, with it touch the water on the cover in different parts, which will have a fine effect when managed with care. Let it stand a few minutes, then take off the water with a clean sponge.

3111. Green Egyptian Marble for Leather Book-Covers. Color the cover in a large vessel, as mentioned before, with Scott's liquid blue; when done, put it into a vessel of clear water for an hour. Take it out and press out the water, then cover the book. Glair the cover; when dry, place it between wands, and drop weak potash water from a sponge thereon; dip the quill-top into the strong black, and touch the water with it. This must be repeated till you have a good black. When dry, clear it with a sponge and water.

3112. Red Egyptian Marble for Leather Book-Covers. Boil Brazil dust in rain-water on a slow fire, with a little powdered alum and a few drops of solution of tin, till a good color is produced. Dip a piece of calf leather into the liquid, and you may ascertain the color wanted. If too light, let it boil till it is reduced to one half of the quantity; take it from the fire, add a few more drops of the solution of tin, and pour it into a large vessel. Put the dry cover on the liquid, and let it remain for a quarter of an hour, then press out the water. Color it over with a sponge and the quercitron bark water, and cover the book. Glair the cover, place it between wands, dash on water with a brush, also potash water; and, lastly, finish it with the strong vinegar black, with the quill-top. Observe that too much black is not put on; the intention of the marble is to show the red as transparently as possible.

3113. Green Marble for Leather Book-Covers. The edge must be marbled with a good bright green only. When the color is prepared with the ox-gall, and ready for use, a few drops of sweet oil must be mixed therein, the color thrown on with a brush, in large spots, till the gum is perfectly covered. The oil will make a light edge round each spot, and have a good effect. Blue, green, and brown may be also used separately in like manner. Sheets of paper may be done, having a trough large enough, and the sheets damped as for printing, before marbling. Spirits of turpentine may be sprinkled on the colors, which will make white spots.

3114. Binders' Thread Marble. Yellow the edge; when dry, cut pieces of thick thread over the edge, which will fall on different parts irregularly; give it a fine dark sprinkle, and shake off the thread. This produces a neat marbled appearance.

3115. Rice Marble, for Leather Book-Covers. Color the cover with spirits of wine and turmeric, then place on rice in a regular manner; throw on a very fine sprinkle of copperas water till the cover is nearly black, and let it remain till dry. The cover may be spotted with the red liquid or potash water, very freely, before the rice is thrown off the boards.

3116. Orange Color for Marbling or Sprinkling Books. Ground Brazil wood, 16 parts; annotto, 4 parts; alum, sugar, and gum-arabic, each 1 part; water, 70 parts. Boil, strain, and bottle.

3117. Tree Marble, for Leather Book-Covers. A marble in the form of trees may be done by bending the boards a little on the centre, using the same method as the common marble, having the cover previously prepared. The end of a candle may be rubbed on different parts of the boards, which will form knots.

3118. Vinegar Black for Bookbinders. Steep iron filings or rusty iron in good vinegar for two or three days, then strain off the liquor.

3119. To Sprinkle Books. Take a stiff brush made of hogs' bristles, perfectly clean, dip it in the color; squeeze out the superfluous liquid; then rub a folding-stick across the brush, and a fine sprinkle will fall on the edge of the book, which should be previously screwed tight in the cutting-press. Repeat the operation until the color is thrown equally on every part of the leaves. The brush should be held in the left hand, and the stick in the right.

3120. Chinese Marble for Leather Book-Covers. Color the cover of the book dark brown, and when dry put it into the cutting-press, with the boards perfectly flat; mix whiting and water of a thick consistence and throw it on, in spots or streaks, some large and some small, which must remain till dry. Spot or sprinkle the cover with liquid blue, and lastly throw on large spots of liquid red. The colors must be dry before washing off the whiting.

3121. Orange Sprinkle for Books. Color the edge with King's yellow, mixed in weak gum-water, then sprinkle with vermilion mixed in the same manner.

3122. Purple Sprinkle for Bookbinders. Logwood chips, 4 parts; powdered alum, 1 part; soft water, 24 parts. Boil until reduced to 16 parts, and bottle for use. Or: Brazil dust (fine), and mix it with potash water for use.

3123. Soap Marble for Books. This is applicable for marbling stationery, book edges, or sheets of paper for ladies' fancy work. Grind, on a marble slab, Prussian blue, with water, and a little brown soap, to a fine pliable consistence, that it may be thrown on with a small brush. Grind King's yellow in the same manner, with water and white soap. When green is intended for the ground color, grind it with brown soap, and King's yellow with white soap. Lake may be used for a ground color, and Prussian blue ground with white soap; brown umber for a ground color, and flake-white ground with white soap. Any color of a light substance may be ground for marbling.

3124. Spotted Marble for Books. After the fore-edge of the book is cut, let it remain in the press, and throw on linseeds in a regular manner; sprinkle the edge with any dark color, till the white paper is covered, then shake off the seeds. Various colors may be used. The edge may be colored with yellow or red before throwing on the seeds and sprinkling with blue. The seeds will make a fine fancy edge when placed very thick on different parts, with a few slightly thrown on the spaces between.

3125. Brown Sprinkle for Leather Book-Covers. Pearlash or potash, 1 part; soft water, 4 parts. Dissolve and strain.

3126. Red Sprinkle for Binders. Brazil wood (ground), 4 parts; alum, 1 part; vinegar, 4 parts; water, 4 parts. Boil until reduced to 7 parts, then add a small quantity of loaf-sugar and gum. Bottle for use.

3127. Black Sprinkle for Leather Book-Covers. Green copperas, 1 part; soft water, hot, 6 parts. Dissolve.

Photography.

Photography is based upon the law or principle that sunlight decomposes certain combinations of the salts of silver. For instance, if a piece of paper is first dipped into a solution of chloride of sodium (common table salt,) and then, when dried, floated on a solution of nitrate of silver, it will, upon being brought to the light, begin to darken, and finally assume an absolute black. It will be seen that if any opaque or semi-opaque body is interposed between the light and the paper, that portion which is so protected from the action of the light remains white, and thus impresses upon the paper, in a negative condition, the form or figure of the article so used.

The entire matter embraced in Nos. 3128 to 3154 is contributed by the eminent photographer, Mr. Geo. G. Rockwood, of New York.

3129. To Make a Photograph Without a Camera. The art of photography has many interesting and useful applications other than portraiture, one of the simplest and most beautiful of which we here present. It can be applied to the copying of laces, drawings, leaves, or anything of a transparent or translucent nature. It is proposed to first describe the manipulations, and then give the formulæ.

3130. Papier Saxe for Photography. The best is the papier saxe, an article made expressly for photography, and may be obtained from any dealer in photographic materials. It is sold in sheets about 18 by 22 inches. The smooth side can be easily selected, and upon that side the print should be made. Cut the paper into the sizes most convenient for the style of picture desired, and prepare the salting solution as follows:

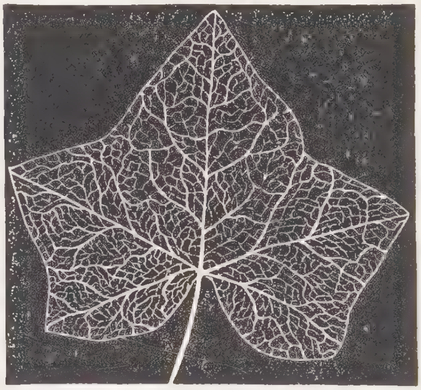
3131. Salting Solution for Photographic Paper. Mix together pure water, 16 ounces; chloride of ammonium or of sodium, 160 grains. Take enough of this to cover a shallow dish of porcelain to the depth of ½ inch or more, and then immerse the paper, one sheet at a time. When a half dozen are in, turn them all over, and take them out one by one, in the order in which they were immersed, and hang them up separately to dry.

3132. Albumenized Paper for Photography. Albumenized paper, such as is used for ordinary portraiture in the galleries, is always ready prepared for silvering. It is much the finest and sharpest in its results, and will usually be adopted; but the most artistic effects will be produced by the use of plain papier saxe. Paper, in either of these forms, prepared with chloride (salt) will keep indefinitely.

3133. Silver Solution to Sensatize Paper. The weather being propitious for printing (a clear, bright sunlight is preferable), the salted or albumenized paper is taken into a darkened room to be rendered sensitive by the silver solution. Make about the same quantity of this as of the salting solution, by using, in the following proportions: Pure water, 1 ounce; nitrate of silver (in crystals), 60 grains. When thoroughly dissolved, pour the solution into a flat porcelain dish, and carefully remove all bubbles, &c.

3134. To Make the Paper Sensitive. Having prepared the silver solution as above directed, take the paper by opposite corners, smooth side down if plain paper, glazed side if albumenized; lower one corner on to the solution, and steadily lower the rest to the surface of the solution, so that the air is completely driven out, and the entire surface exposed to the action of the silver. Be very careful that the solution does not get on the back of the paper. Plain paper (papier saxe) should float 2 minutes; albumenized, 3 minutes. Carefully raise the sheet from the solution, and hang up to dry in a perfectly dark room. It is best to proceed with the printing as soon as the paper is dry. Additional brilliancy and sensitiveness is imparted to the paper by exposing it, after it is thoroughly dry, to the fumes of ammonia. This may be done by hanging it up with a clip or pin in a close box, in which is a small dish containing aqua ammonia F.F.F. This fuming process may be dispensed with, yet the prints are much more uniform when treated with the ammonia.

3135. To Copy an Object. Having prepared, in a dark room, a sheet of paper as above, lay it upon a piece of glass; place upon the glass a leaf as translucent as can be found, and then above it, to hold it in place, another piece of glass, and at each corner a clip, or a common spring clothes-pin. Now expose the plates so arranged, leaf side up, to the sun's rays. The paper will at once begin to darken, and in from 5 to 10 minutes, except under the leaf, be entirely black. If the plates are now taken into a dark room and separated, the image of the leaf, with all its delicate tracery and beautiful lines, will be found upon the paper, white, with black background. It would be well to put under the sensitive paper a few thicknesses of soft paper, or black cotton velvet. It serves as a pad or cushion, and tends to press the paper up into a closer contact with the inequalities of the leaf, lace, or object used as a negative or cliché. Small printing frames can be purchased at a moderate sum, which will enable the experimenter to examine the progress of the work and ascertain when the print is sufficiently exposed to the action of the light. The exposure should continue until the image is much darker than intended when finished, as the after processes of toning and fixing reduce or bleach the pictures very considerably. As the prints are taken out of the frame, put them away in the dark again, until ready for the toning bath.



3136. To Prepare a Picture for Toning and Fixing. It will now be necessary to *tone* and *fix* the picture, in order that the image be rendered permanent. The first process is to soak the print in a dish of clear water for a few minutes, and thus wash off the free nitrate of silver remaining upon the surface of the paper. A half hour's soaking, with one or two changes of the water, will effect this so that it is ready for the toning bath.

3137. To Prepare a Toning Bath. Chloride of gold is sold in bottles containing 15 grains. Dissolve this in 30 drachms of water, add a drop of hydrochloric acid, and preserve it as a stock solution in a bottle; mark this *gold solution.* Make in another bottle a saturated solution of washing soda, also as a stock solution; mark it as such: *Soda solution.* When the prints have been washed as before directed, and are ready for toning, mix 1 drachm of the gold solution with 1 ounce of water, according to formula. Pour into a tray, and drop in a small piece of blue litmus paper; it will become red. Render the bath alkaline by adding from the soda solution, drop by drop, until the paper begins to change blue again. It is better to prepare the toning bath during the day, while the printing is being done, as the bath seems to work with more smoothness and uniformity. It may be used, however, so soon as mixed.

3138. To Tone a Picture. The print is now taken by two corners and immersed in the gold or toning bath. At first the print will begin to bleach, and turn a warm red color, which soon changes into a beautiful warm black. Put in the prints one by one, keeping them separated or constantly in gentle motion, when the changes already spoken of will occur. When a deep purple or warm black is obtained, remove them to a basin of clean water, and rinse them until all are toned, when they are ready for immersion in a fixing bath, to render them permanent.

3139. To Prepare a Fixing Bath. Take water, 6 ounces; hyposulphite of soda, 1 ounce. This solution dissolves from the paper all of the chloride of silver that has not been acted upon by the light, but does not injure the picture or image. The usual time for leaving the print in this bath is about 15 minutes. If the print is held up to transmitted light before it is placed in this solution, it will appear quite opaque and cloudy in what should be the clear parts of the picture. After the print has been in the bath the proper time this will disappear, and the print have a clear, translucent effect. The print should now be washed in 2 or 3 waters, and left to soak in a dish of water all night. In the morning it can be hung up to dry, and then mounted, as the taste of the experimenter may suggest. If the saving of time is an object, the print, after coming from the fixing bath, can be rinsed in water and passed through a common clothes-wringer a few times, each time being dipped in clean water, when the print will be found to be perfectly washed. When properly fixed, as already described, they are to be washed, and finally mounted on card or bristol board. The best paste for this purpose is common laundry starch.

3140. Precautions to be Observed in Making a Picture. When directions are given to prepare and keep the sensitive paper in a dark room, it should, of course, be understood that daylight only is to be excluded; gas or candle light will do no harm. A window closely covered with yellow paper completely filters the light of all actinic or chemical power, and consequently will do no harm. Be careful that not a drop of the fixing solution gets into the gold or toning bath. After the final process of fixing, take the greatest care that the prints do not again come into contact with the hyposulphite of soda. Soda is good—indispensable in its place, but exceedingly harmful out of its place. So keep all the dishes and fingers free from it. In all of the manipulations, observe the most perfect neatness. Handle the prints with the tips of your fingers, and always with deliberation and care. If the silver solution grows weak by use—a mealy look to the prints indicates it—add a few grains of nitrate of silver. If by use it turns a dark wine color, and the paper is not white when dry, set the solution in clear sunlight for a day or two and it will clear. Filter before using again. The soda (fixing) bath should not be used more than 2 or 3 times. Where prints are only occasionally made, a fresh bath should be made each time of printing. The gold (toning) bath works quicker when warmed to about blood heat. Prints will then tone in from 2 to 6 minutes. Prints on plain paper will tone quicker than on albumenized. If prints are undertoned they will present a warm brown appearance; if toned too much, a cold steel color. A little experience will soon indicate the precise amount of toning required.

3141. To Remove Nitrate of Silver Stains. An inevitable consequence of practicing this process will be stains on the hands and clothing from the nitrate of silver. Moisten the spots with tincture of iodine, and then with a saturated solution of hyposulphite of soda. Cyanide of potassium acts more energetically, but is a very dangerous poison, and is not recommended.

3142. The Photographic Negative or Cliché. In number 3128 we have stated the general principles of the photographic art; that it was based upon the fact that solar light decomposes certain combinations of the salts of silver; that in proportion or to the extent that such sensitive surface is exposed to the action of light, so is the depth of the stain or intensity of the image upon the prepared paper. Now if we should cut from an opaque or black piece of paper, any form or figure—an old fashioned *silhouette* would be a familiar illustration—and place it upon the silvered paper, the precise image or form cut in the paper would, upon removal, be found upon the paper; the paper remaining white under the figure leaf or "*theorem*," while the parts exposed to the light have turned black. In place of this figure, science has given us *the Photographic Negative or Cliché.* A negative is an image produced upon glass by a camera (an improved form of the old camera obscura) and derives its name from the fact that the image is *reversed* or *negative* by transmitted light (looking *through* it), the lights appearing dark, and the dark parts light. The chemicals used to produce it are also combinations of the salts of silver, but are so sensitive to the action of light, that they are decomposed *instantaneously* by exposure. The formulæ will follow a description of the process.

3143. To Make a Photographic Negative. In a room illuminated only by a feeble gas or candle light, or by such daylight as is filtered of its chemical power through a sheet of yellow glass, a glass plate is carefully flowed with collodion. (*See No.* 3149.) When the plate has been evenly covered, the excess is quickly but *deliberately* returned to the bottle, and the plate gently and slowly swayed from side to side until the collodion is set, or when the surface is tacky to the touch. It is then placed on a dipper, and, with a steady, continuous motion, immersed, collodion side upwards, in the silver bath. (*See No.* 3150.) If the plate is stopped in its descent into the bath, a *check* or line will show across its face. In 3 to 5 minutes, depending upon temperature, etc., the plate is *coated*, or, in other words, the chemicals in the collodion have united with the nitrate of silver, forming the sensitive surface or coating. If not coated sufficiently the surface will appear *greasy;* in this case the plate must be returned to the bath until the film appears perfectly smooth. While this is being done it is supposed that the operator has adjusted the camera upon the object to be photographed by focussing his lens. This is done by turning the lens in and out, or from and towards the ground glass of the camera, until the point is ascertained which gives the sharpest image upon the ground glass. All being ready, the operator returns to the dark room for his sensitive plate. This is placed in a "holder," and the ground glass being removed, the holder is substituted in its place. The slide or cover to the holder is now withdrawn and the sensitive plate exposed to the action of the image of light thrown upon it by the lens. After an exposure of 15 to 60 seconds, depending so much upon the intensity of the light that it can only be ascertained by experience, the slide is replaced in the holder and the plate taken to the dark room for development.

3144. To Develop a Negative. This is done by removing the plate from the holder, and, holding the plate in a horizontal position, flowing it with the developing solution. (*See No.* 3151.) If properly timed or exposed, the image begins to appear. When the details of the drapery, if a portrait, appear and the solution seems to have lost its power, the plate is thoroughly washed under a stream of clean water. If the image is sufficiently strong and vigorous, it is "cleared" by placing the plate in the fixing bath, and that portion of the film *not* acted upon by the light is dissolved away, leaving the image upon the glass. After a thorough washing in water, the plate is put in a rack to dry, after which it is slightly warmed and varnished.

3145. To Varnish a Negative. The varnish (*see No.* 3153) is flowed on and off precisely as with the collodion. (*See No.* 3143.) It should be again slightly warmed to prevent the varnish from chilling or *blooming.* When dry, which will be in 5 to 10 minutes, the negative is ready for use as described in Nos. 3135, &c., using the negative instead of the leaf. Should the image have evidence of full exposure by the existence of all the proper detail, and yet want vigor or intensity, this may be imparted, *before* varnishing, by *re-development.*

3146. To Re-develop a Negative. This is done by pouring upon the plate about 1 ounce of the pyrogallic acid solution to which has been added 5 or 6 drops of the silver solution designated for that purpose. (*See No.* 3152.)

3147. Glass for Photography. For portraiture and ordinary landscape photography, the best qualities of picture or window glass will suffice. There is an article sold by dealers in photographic materials, known as photographic or negative glass, which is selected for the purpose and cut into the regular sizes used in the art, viz., stereoscopic, "quarter" size, "half" size, "four-four" &c., the latter being 6½×8½ inches and the other sizes fractional parts, as their names suggest. For microscopic and scientific experiments, plate glass would be preferable. A quality known as "three quarter white" plate, and only of the thickness of ordinary single thick window glass, has all the requisites for *exact* photography. When it is proposed to print photographs upon glass, for magic lanterns or transparencies, plate glass is absolutely essential.

3148. To Prepare Glass for Photography. All new glass should be placed for a few minutes in a strong solution of commercial nitric acid (say 1 ounce nitric acid to 3 ounces water), and then thoroughly washed in clean water. While wet, pour upon the glass a solution consisting of white of egg, 1 ounce; water, 20 ounces; drain off into a separate bottle, or clean, filter, and set up in a rack to dry. The albumen and water solution, before using, should be very thoroughly beaten together. After the froth has subsided, filter the solution through a clean sponge, two or three thicknesses of linen, or, still better, filtering paper. The solution above named will coat more plates than an amateur would be likely to use. *Use fresh eggs and a newly made solution whenever coating plates.* The plates so prepared will keep indefinitely.

3149. Collodion for Photography. Collodion is the vehicle by which the photographic chemicals are united upon the surface of the glass and the sensitive coating produced. It is made by dissolving in equal or nearly equal proportions of sulphuric ether and alcohol, gun cotton or pyroxyline together with certain salts of potassium, cadmium, ammonium, &c., in proportions named in the formulæ. Many formulæ are published for this article to which great value is attached, some supposing that to its peculiar composition belong the principal causes of failure or success. This is only in a degree true. Inferior or carelessly prepared chemicals used in any stage of the process impair results. The writer has fixed as a general principle in the preparation of collodion the proportion of 1 grain of the exciting salts (in each ounce of collodion), to every 10 grains of silver in the bath. To illustrate: If the silver bath solution is at 50°, or, more definitely, 50 grains of silver to each ounce of water, we would make the collodion so as to contain in each ounce of collodion 5 grains of the various salts of cadmium, ammonium, &c.; or another way of putting it, the bath should be ten times as strong as the collodion. The sensitizing salts should be selected with a special reference to the peculiarities of the light or subjects. It can be made under one formula to cover almost all emergencies; yet special kinds of work for extremes of light or shadow can be improved by varying the combinations of the exciting or sensitizing salts. For portraiture in a room of evenly diffused light the iodide of cadmium as the principal excitant gives softness and delicacy to the image. Thus:

I. Take of sulphuric ether, 1 ounce; 95 per cent. alcohol, 1 ounce; gun cotton, 6 grains; iodide of cadmium, 4 grains; bromide of cadmium, 2 grains.

II. Sulphuric ether, 1 ounce; alcohol, 1 ounce; gun cotton, 6 grains; iodide of cadmium, 3½ grains; bromide of potassium, 2½ grains.

These two formulæ give the utmost delicacy and transparency to the shadows, and work with rapidity, when preserving their proper relations to the silver bath solution, of which we speak in the proper place. If more brightness is desired to the image, instead of the iodide of cadmium put the same quantity of iodide of ammonium. If still greater contrasts are required, use iodide of potassium in place of either the cadmium or potassium. The latter is favorable for copying engravings, maps, plans, &c., in which strong contrasts of white and black are desirable. It is well to prepare from all these formulæ and then modify results by mixing them together as the subjects or light may demand. Farther combinations may be suggested; under a feeble light, or where there are large masses of shadow, *reduce* the amount of the iodide salt one grain and *increase* the bromide one grain.

IN COMBINING THE INGREDIENTS, measure out the required quantity of alcohol, and *to it* add the gun cotton and such of the exciting salts as dissolve in alcohol, and lastly the ether. Shake until all are thoroughly dissolved, and put aside over night to settle. When clear, decant into the flowing or coating bottle for use. Such of the excitants as do not dissolve in alcohol should be dissolved in as small a quantity of water as is possible and added to the alcohol, &c., *a little at a time*, and quickly shaken.

3150. Silver Bath. Make a solution in the proportion of 60 grains nitrate of silver to 1 ounce water. Test the solution with litmus paper, and if slightly alkaline, or neutral, add nitric acid to produce a *faint* red reaction to the paper. The best method is to add a few drops of chemically pure nitric acid to an ounce of water, and add this solution to the silver bath a *very few* drops at a time. Then coat a plate with collodion and let it remain in the bath all night. The freshly made collodion can be used for this purpose, and thus both collodion and silver solution or bath be made ready for work at the same time.

3151. Developing Solution. This may be made in stock solution of the simple sulphate of iron and water, and then reduced in strength and made ready for use each day. For the stock solution take water, 16 ounces; sulphate of iron, 4 ounces. Dissolve and filter. When wanted for use, take stock solution, 1 ounce; water, 4 ounces; acetic acid (No. 8), ½ ounce. The addition of about ½ ounce alcohol to the above formula often facilitates the smooth flowing of the solution on the plate. It is particularly essential when the bath has been in long use and is "saturated" with ether and alcohol from the plates.

3152. Re-developing Solution, for adding vigor and intensity to the negative, is made of water, 1 ounce; pyrogallic acid, 1 grain; citric acid, 1 grain. Pour into a small beaker or cupping glass about 1 ounce of this solution, and add, by means of a pipette, 5 or 6 drops of a solution of 20 grains nitrate of silver dissolved in 1 ounce water. Immediately flow this solution over the plate, occasionally returning the solution to the little beaker glass. As soon as the solution begins to assume a wine color, it is acting with vigor on the negative and should be closely watched, that the negative does not become too intense. When sufficiently dense, throw away the solution and thoroughly wash both the negative and the glass. The latter should always be kept perfectly clean and free from any deposit from the re-developing solutions.

3153. Negative Varnish of excellent quality can always be secured at the dealers in photographic materials. In an emergency common shellac varnish, somewhat thinned down with alcohol, and filtered through cotton, will answer the purpose. (*See No.* 2935.)

3154. The Causes of Failure would almost require a chapter by themselves; a long experience convinces us that nine out of every ten failures occur from a want of care, the presence of dirt, negligence. One cannot be over-nice, careful or cleanly—the best results always rewarding the most painstaking.

3155. To Enamel Cameo Pictures. Ordinary well polished glass plates are coated with normal collodion of the usual description, and when the film has set perfectly, but has not become completely dry, the pictures, which have previously been trimmed and finished, are dipped rapidly into alcohol, and applied without delay to the plates. The prints are pressed and rubbed down with smooth writing paper, and the operation of mounting is proceeded with as soon as the backs of the pictures have become white; or, in other words, as soon as the alcohol has again evaporated. The cardboard should be allowed to remain in water for at least half an hour previously to its being employed for mounting. The more rapidly the pictures are applied and pressed upon the collodion surface, the more beautiful will be the finished result.

3156. Photographic Impressions With Fuchsine. A piece of linen goods colored with fuchsine, and dried, was exposed to the light under a photographic negative, when the image of the plate became visible on the goods, the picture looking greyish and faded where the lights were strongest. Still the picture was rather weak, and the goods were soaked for 2 days in a bath of sulphate of copper, when the picture was found to be more developed. After several rinsings in water, and two days' exposure on the grass, the rest of the goods were bleached white, leaving the picture of a pure violet tint on a white background.

3157. Tapioca Paper. To prepare tapioca paper, which is very useful for copying photographs by artificial light, 200 grammes (6½ Troy ounces) of tapioca are soaked for 2 days in an equal weight of water; 10 litres (about 21 pints) of water are added, and afterwards, for every litre (quart) of liquid, 10 grammes (154 grains) iodide of potassium, 30 grammes (463 grains) chloride of potassium, 1 gramme (15½ grains) bromide of potassium, are dissolved, and the whole boiled for 10 minutes, allowed to stand for a day, and decanted and filtered through fine linen. The paper is immersed, 12 or 20 sheets at a time—or can be floated upon it—for 15 to 20 minutes; it is then hung up to dry in a dark room. If it has assumed a dark color, that is of no consequence, as it disappears in the silver bath. This is to be prepared in the proportion of 1 ounce nitrate of silver, 50 to 60 grains of citric acid in 30 ounces of water. The time of exposure varies from 10 seconds to 25 minutes, according to the picture to be copied and the actinic force of the light.

3158. To Recover Gold and Silver from Photographic Solutions. The silver and gold waste that result from photographic operations are best collected in a large bottle or jar, together with anything else that might contain either of the two metals. When the bottle is nearly full, pour a little hydrochloric acid and a solution of green sulphate of iron (copperas) into it, and let it stand on a warm place until the supernatant liquid appears perfectly clear. Add then a few drops more of the hydrochloric acid and iron solution, and observe whether a fresh precipitate forms or not. In the latter case, draw the clear liquid off by means of a syphon, and reserve the residue. If the bottle has become partially filled in course of time with insoluble chloride of silver and metallic gold, place the residue on a filter, wash it with very dilute acid, and, lastly, with water. After drying, it is to be mixed with several times its weight of dry carbonate of soda, the whole conveyed to a crucible, and the latter heated to a bright red heat, and kept there for about 10 minutes. After taking the crucible out of the fire, and allowing it to grow cold, it is broken, the button of the alloy of gold and silver cleaned, and heated in a suitable vessel with dilute nitric acid, which will dissolve all the silver, as nitrate of silver, and leave the gold in a finely divided state. This is dissolved by nitro-hydrochloric acid (aqua regia). It is hardly necessary to say that, for photographic purposes, both solutions must be evaporated in a water-bath until the excess of acid has been volatilized, when they may be diluted with a sufficient amount of water, and used. (*See No.* 3166.)

3159. Simple Method of Copying Drawings, Etc. Silvered albumen paper, after being washed, may be conveniently used for copying negatives as well as positives. It keeps for weeks, and becomes sensitive to light only after exposure to the vapors of aqua ammonia, technically termed smoking with ammonia. Dr. H. Vogel has greatly simplified the latter process by substituting for the liquid ammonia the powder of carbonate of ammonia. He thoroughly impregnates a piece of felt or cloth with this powder, and lays it under the silvered sheet, separated from it by a piece of blotting-paper. He places the silvered paper, with the substratum of carbonate of ammonia and the drawing on top, between two plates of glass, and, exposing it to the light of the window, obtains a copy quite distinct in all its details. The copy obtained is, of course, in white lines upon black ground. Such photographs require to be treated with soda when intended for long preservation.

3160. Lea's Solution for Cleaning Photographic Glasses. Water, 1 pint; sulphuric acid, ½ ounce; bichromate potash, ½ ounce. The glass plates, varnished or otherwise, are left, say 10 or 12 hours, or as much longer as desired, in this solution, and then rinsed in clean water, and wiped or rubbed dry with soft white paper. This preparation is by Mr. Carey Lea, of Philadelphia, and is said to be the best in use. It quickly removes silver stains from the skin without any of the attendant dangers of the cyanide of potassium.

3161. Wenderoth's Photographic Varnish. Nearly all photographic varnishes reduce the intensity of the negative. Mr. F. A. Wenderoth, of Philadelphia, states that if a thin solution of gum-arabic is applied to the negative after fixing and before drying, the varnish will not affect the intensity. This is a very simple and useful remedy. Mr. Wenderoth also states that he has long practiced the covering of photographic paper prints upon both sides with collodion varnish, and finds it a complete preservative of the picture. Nearly all photographs will fade away in a few years unless thus protected.

3162. Collodion Varnish for Photographic Prints. A very effective and agreeable polish is communicated to card or cabinet prints, etc., simply by coating them with a glutinous plain collodion, made as follows: Alcohol, 3 ounces; ether, 4 ounces; pyroxyline, 42 grains. Dissolve and filter in the usual manner. The prints are first cut to the proper size and floated on the reverse side upon clean water until they lie perfectly flat; then take one print at a time and place it on a piece of glass of the same size as itself, moist side downwards; it easily adheres to the glass. Let the excess of water drain off, and remove all moisture from the picture surface; now coat it with the collodion and let it drain in the usual way, then dry it before the fire or in any manner which is most convenient. This polish is not so flagrant on the one hand as the so-called enamel surface, nor so dead as an ordinary albumen print that has undergone all the operations up to the mounting.

3163. Preservation of Photographs. H. Cooper, Jr., of England, gives the following formula for a preservative varnish which is stated to be an entire protection against fading: 1 drachm gum damar dissolved in 1 ounce benzole. 1 drachm paraffine, dissolved in 1 ounce benzole. Mix 4 parts of the paraffine solution with 1 part of the damar solution. Photographic prints covered with this varnish are impermeable to water. A solution of the paraffine only will do; but it is better with the gum damar.

3164. Everlasting Photographs on Enamel. First-class photographs, either negatives or positives, may be taken on Duchemin's enamel (*see No.* 2402) without collodion, by using bitumen, or citrate of iron, or perchloride of iron and tartaric acid, or bichromate, or any other salt. A good solution for this purpose is, water, 100 parts by weight; gum, 4 parts; honey, 1 part; pulverized bichromate of potash, 3 parts. Filter the liquid, spread it over the enamel, and let it rest, after which, expose it to the camera. Develop the image by brushing over it the following powder: Oxide of cobalt, 180 parts by weight; black oxide of iron, 90 parts; red lead, 100 parts; sand, 30 parts. Decompose the bichromate by immersion in a bath formed of water, 100 parts by weight; hydrochloric acid, 5 parts. Wash it in clean water and dry it; and lastly, vitrefy the proof on a clean piece of cast iron, the surface of which has been previously chalked. One minute will suffice for indelibly fixing and glazing the photograph, which must be carefully and slowly allowed to cool. Photographs on enamel of any size, taken in this manner, are perfectly unalterable under all atmospheric conditions, and may consequently and aptly be called everlasting photographs.

3165. Searing's Process for Photographing on Wood for Engraving. The block on which the picture is to be made is first dampened with water, then whitened with enamel rubbed from the surface of good enameled visiting cards. Rub gently, removing only the enamel, after which it is brushed smooth with a moderately stiff brush, from right to left and up and down, making a smooth, even, and very thin surface. Allow this to dry, after which it is flowed with a solution of albumen, made with the white of 1 egg and 16 ounces of water, dried by heat or allowed to dry spontaneously. Now coat it with another albumen solution made as follows: White of 1 egg; water, 4 ounces; chloride of ammonia, 40 grains. Beat the whole to a thick froth. Allow to subside, then decant or filter through a fine sponge placed in a glass funnel. Pour a sufficient quantity on one corner of the block to cover it, when spread around with the aid of a ⅛ or ⅙ glass (using the edge). Allow the surplus solution to drain back into the bottle. Dry this by a gentle heat. Next flow on, in the dark room, solution No. 3, prepared as follows: Ether, 1 ounce; alcohol, 1 ounce; gun-cotton, 8 grains; nitrate of silver, 30 grains; dissolve in as small a quantity of water as possible, and allow to settle for a few days, protected from the light. Again dry the block by gentle heat. It is now ready for exposure under the negative. A porcelain printing-frame, or any other suitable method, may be used to print it. After printing, solution No. 3 is removed from the surface of the block by dissolving in ether and alcohol, assisted by rubbing gently with a soft sponge. The picture can now be toned and fixed in the ordinary way, or fixed and toned at one operation, by the hypo and gold bath. After being allowed to dry, it is ready for the engraver.

3166. To Recover Silver from Photographic Waste. To obtain the silver from a photographic bath, or from the rejected photographs and clippings, is a most important measure of economy in the art. The bath should be filtered, and a solution of common salt added; this precipitates chloride of silver, which is to be collected on a filter, dried, and washed; then the metallic silver may be obtained from it by the action of metallic zinc, a strip of which being placed in the pulpy mass, will combine with the chloride, and leave the silver in a spongy mass of a gray color; after washing, this may be dissolved in nitric acid and crystallized. Another process is to mix the chloride with nitrate of potassa and fuse in a crucible—the silver is thus obtained in a button. The papers must be incinerated, the ashes collected and treated with nitric acid and heat; diluted with water, and filtered; it is now an impure solution of silver, to be treated in the same way as the bath. (*See No.* 3158.)

3167. To Clean off Collodion Pictures. A tuft of cotton dipped in methylic alcohol, and rubbed over the surface of the picture, will remove it entirely, whether varnished or not.

3168. Paper for Photography. The paper used for photography may be the finest satin post paper, of uniform texture, free from the maker's mark, specks, and all imperfections. The papers must be prepared by candle-light, and kept in the dark till used.

3169. Simple Nitrated Paper. This is merely paper brushed over with a strong solution of nitrate of silver. In brushing over the paper it must not be crossed. Its sensitiveness is increased by using spirits of wine instead of water. This paper only requires washing in water to fix the drawing.

3170. Muriated Paper. The paper is first soaked in solution of common salt, pressed with a linen cloth or blotting-paper, and dried. It is then brushed over on one side (which should be marked near the edge) with the solution of nitrate of silver, and dried at the fire. The stronger the solution, the more sensitive the paper. If the barytic solution (*see No.* 3181) be used instead of common salt, richer shades of color are obtained. A solution of 10 grains sal ammoniac in 1 ounce water gives a very sensitive paper. A due proportion must be observed in the silver and salt solutions, as follows:

Sensitive paper for the camera, use 50 grains common salt to 1 ounce water; and 120 grains nitrate of silver to 1 ounce water. Or: 60 grains of the nitrate with 40 grains muriate of ammonia, and 4 ounces water. Or: 100 grains nitrate with the barytic solution. (*See No.* 3181.)

Less sensitive, for copying engravings, botanical and entomological specimens, &c. The salt solution to contain 25 grains salt to 1 ounce water. The silver solution 90 grains in 1 ounce water.

For copying lace-work, feathers, patterns, &c. The salt solution, 20 grains; the silver solution, 40 grains to 1 ounce. To fix the drawing on these papers, they must be first washed in lukewarm water, then dipped twice in solution of hyposulphite of soda (1 ounce to 1 pint), then in pure water, and dried.

3171. Iodized Paper. Brush over the paper on one side (which should be marked) with strong solution of nitrate of silver (100 grains to 1 ounce); then dip it in solution of iodide of potassium (25 grains to 1 ounce); wash it in distilled water, drain, and dry it.

3172. Bromide Paper. Soak the paper in solution of bromide of potassium (40 grains to 1 ounce); then brush it over with strong solution of nitrate of silver, and dry in the dark.

3173. Chromatype Paper. Simple chromatype paper is prepared as follows: Soak the paper in the *simple* solution (*see No.* 3182), and dry it at a brisk fire. To fix the drawing, careful immersion in warm water is all that is required. It is not sufficiently sensitive for the camera.

For COMPOUND CHROMATYPE PAPER. Wash the paper with the *compound* solution (*see No.* 3182), and dry it. After the paper has been exposed to the sun with the article to be copied superposed upon it, it is washed over in the dark with a solution of nitrate of silver of moderate strength. A vivid picture makes its appearance, which is sufficiently fixed by washing in pure water. For copying engravings, &c. Another method is to brush writing paper over with a solution of 1 drachm of sulphate of copper in 1 ounce of water; and when dry, with a strong but not saturated solution of bichromate of potash.

3174. Cyanotype Paper. Brush the paper over with a solution of ammonio-citrate of iron. Expose the paper in the usual way, then wash it over with a solution of ferrocyanide of potassium.

3175. Crysotype Paper. Wash the paper with solution of ammonio-citrate of iron, dry it, and afterwards brush it over with a solution of ferrocyanide of potassium. Dry it in a dark room. The image is brought out by brushing it over with a neutral solution of gold or of silver.

3176. Calotype Paper. The paper is saturated in 1 ounce water, containing 20 grains iodide of potassium, and dried. Then made sensitive by soaking in 1 ounce distilled water containing 20 grains nitrate of silver and ½ drachm glacial acetic acid, and dried in a dark room.

3177. Instantaneous Positive Paper. Mix 6 drachms of a saturated solution of bichloride of mercury with 1 pint distilled water. Float the paper on this solution in a flat dish. Dry it; take into a dark place lit by a candle with a yellow glass, and render it sensitive by a solution of 38 grains nitrate of silver to 1 ounce water. To print, expose to a perpendicular light from 2 to 10 seconds in summer, about 1 minute in winter; then immediately cover with a black cloth. The image, at first very feeble, is developed by this solution; sulphate of iron, 15 grains; glacial acetic acid, 25 grains; distilled water, 1 ounce. The deepening of tint must be watched, and arrested at the proper moment. Then wash, and fix with hyposulphite.

3178. Albumenized Paper for Positive Printing. White of egg, and water, equal parts; iodide of potassium or chloride of sodium, 5 grains to 1 ounce water (or bromide of potassium, 20 grains). Coat the paper with this solution. Dry. Immerse in the dark in bath of 120 grains nitrate of silver to 1 ounce water. Dry again. This is exposed with the negative over it, for 10 to 15 minutes.

3179. Prepared Wax Paper. Make a strong size by digesting 25 parts gelatine, 50 of linseed, and 150 of rice flour, in 2000 to 3000 parts hot water. Filter through a cloth. Take of this size, when cold, 1000 parts by weight, and dissolve in it sugar of milk, 50 parts; iodide of potassium, 35; bromide of potassium, 5 parts.

3180. Artificial Ivory for Photographers. Sheets or tablets of gelatine or glue are immersed in a solution of alumina. When entirely penetrated by the alumina, the slabs are to be removed, dried, and polished like ivory. (*Mayall.*)

3181. Barytic Photographic Solution. Dissolve 35 grains chloride of barium in 2 ounces distilled water.

3182. Chromate Photographic Solutions. *Simple chromate solution* is a saturated solution of bichromate of potash; a little sulphate of indigo being sometimes added to vary the color.

The *compound chromate solution* consists of 10 grains bichromate of potash, and 20 grains sulphate of copper, dissolved in 1 ounce distilled water.

3183. Hydriodate of Iron and Barytes Photographic Solution. Hydriodate of barytes, 40 grains; water, 1 ounce; pure sulphate of iron, 5 grains; mix, filter, add a drop or two diluted sulphuric acid, and when settled decant the clear liquor for use.

3184. Hardwich's Gold Toning Bath for Positive Printing. Pure chloride of gold, 1 grain; hyposulphite of soda, 1 to 3 grains; hydrochloric acid, 4 minims; water, 4 ounces.

3185. Mayall's Method of Cleaning Photographic Glasses. Shake up together 30 parts alcohol, 10 parts strong liquid ammonia, 40 parts water, and 30 parts fine Tripoli. The plates are to be rubbed hard and evenly with balls of cotton-wool dipped in the mixture. When dry, rub again with a clean ball of cotton, and dust off the back and edges with a clean hog's-hair brush.

Metals.

Metals are elementary or undecompounded bodies, which are distinguished by their weight, lustre, fusibility, power of conducting heat, electricity, &c. (*see Nos.* 3349 *to* 3357 *inclusive*), and the numerous compounds which they furnish by combination with one another, and with other bodies. When their solutions are decomposed by a galvanic current, the metals always appear at the electro-negative surface, and are hence termed *electro-positive* bodies.

3187. Assaying. The method of determining the quantity of pure gold and silver in the alloys of these metals. This art requires great skill and experience in its performance; and, from the costliness of the precious metals, is of the utmost importance. A downward draught furnace of any shape and size may be employed, provided it will afford a sufficient heat, and allow the introduction of the muffle. The muffle is a pot made of clay, and furnished with an opening at its end, to admit the introduction of the cupels, and to allow of inspection of the process. It is placed on the muffle-plate, by which it is introduced into the furnace. The cupel is a sort of shallow crucible, made of bone ashes or burnt bones. At the British mint the cupels are made of the calcined cores of ox-horns. The powder is slightly moistened with water, and a circular steel mould is filled therewith, and after being pressed down tight, is finished off with a rammer, having a convex face of polished steel, which is struck forcibly with a mallet, until the mass becomes sufficiently hard and adherent. The cupel is then carefully removed, and exposed in the air to dry, which usually takes from 14 to 21 days. The muffle, with the cupels properly arranged, being placed in the furnace, the latter is filled up with charcoal, and lighted at the top by placing a few pieces, heated to whiteness, on last. When the cupels have been exposed for half an hour, and have become white by heat, the lead is put into them by means of a pair of tongs, and as soon as this becomes thoroughly red and circulating, as it is called, the metal to be assayed, wrapped in a small piece of paper, is added, and the fire kept up strongly until the metal enters the lead, and circulates well, when the heat may be slightly diminished, and so regulated that the assay shall appear convex and ardent, while the cupel is less red—that the undulations shall circulate in all directions, and that the middle of the metal shall appear smooth, surrounded with a small circle of litharge, which is being continually absorbed by the cupel. This treatment must be continued until the metal becomes bright and shining, or is said to "lighten;" after which certain prismatic colors, or rainbow hues, suddenly flash across the globules, and undulate and cross each other, and the latter metal soon after appears very brilliant and clear, and at length becomes fixed and solid. This is called the "brightening," and shows that the separation is ended. In conducting this process, all the materials used must be accurately weighed, especially the weight of the alloy before cupellation, and the resulting button of pure metal. The difference gives the quantity of alloy. The preceding general description of the process of cupellation will render the following articles intelligible, without again entering into the minutiæ of the operation. An assay is thought to be good when the bead is of a round form, with its upper surface brilliant, its lower one granular and dead-white, and when it separates readily from the cupel. When the surface of the bead is dull and flat, it shows that too much heat has been employed; and if the metal be silver, some may have been lost in the process, by fuming or absorption. When the bead is spongy, and of various colors, and scales of litharge still remain on the cupel, and the metal adheres strongly to the latter, too little heat has been used, and the button still retains some lead. To remedy this, the heat should be raised, and a little powdered charcoal, or a few small pieces of paper, thrown into the cupel, until the metal again begins to circulate freely. It is necessary that the lead employed in the process of cupellation should be perfectly pure. It ought, therefore, to be procured by reducing refined litharge. (*Cooley.*)

3188. Puscher's Solution for Coloring Metals. This is a new method of giving metals a durable colored coating, and can be executed quickly and cheaply. To prepare the solution dissolve 1½ ounces hyposulphite of soda in 1 pound water, and add 1½ ounces acetate of lead dissolved in ½ pound of water. When this clear solution is heated to 190° to 210° Fahr., it decomposes slowly, and precipitates sulphide of lead in brown flocks. If metal is now immersed in it a part of the sulphide of lead is deposited thereon, and according to the length of time and consequent thickness of the deposited sulphide of lead, the various and beautiful lustre colors are produced. In 5 minutes there may be imparted to *brass* articles a color varying from a beautiful gold to a copper red; then carmine red; then dark, then light aniline blue, to a blue white, like sulphide of lead; and at last a reddish white, according to the length of time they remain in the solution used. The colors possess the most beautiful lustre, and if the articles to be colored have been previously thoroughly cleaned by means of acids and alkalies, they adhere so firmly that they may be operated upon by the polishing steel. To produce an even coloring, the articles to be colored must be evenly heated.

Iron treated with this solution takes a steel blue color; *zinc*, a brown color; in the case of *copper* objects the first gold color does not appear; lead and zinc are entirely indifferent.

If, instead of the acetate of lead, an equal weight of sulphuric acid be added to the hyposulphite of soda, and the process carried on as before, the *brass* is covered with a very beautiful red, which is followed by a green, and changes finally to a splendid brown with green and red iris-glitter; this last is a very durable coating, and may find special attention in manufactures. (*See No.* 3313.)

Very beautiful marbleized designs can be produced by using a lead solution thickened with gum tragacanth on brass which has been heated to 210° Fahr., and afterwards treated by the usual solution of sulphide of lead. The solution may be used several times, and is not liable to spontaneous change.

Gold. The most marked properties of metallic gold are its ductility, malleability, and insolubility in all menstrua, except aqua regia and aqueous chlorine, and its slight affinity for oxygen. Native gold has a specific gravity of 13.3 to 17.7; pure gold, about 19.3; its greatest density is 19.5. Its fusing point is 2016° Fahr. It is characterized by its yellow color, its insolubility in nitric acid, and ready solution in nitromuriatic acid (aqua regia), forming a yellow liquid that stains the skin purple.

3190. Assay of Gold by the Use of Touch-Stones. When it is desired to ascertain the fineness of small quantities of gold, as in jewelry, &c., touch-needles and stones are employed. The former are made in sets, containing gold of different fineness and differently alloyed with copper and silver. Pieces of black pottery form excellent touch-stones. The mode of using them is to mark the stone with the sample under examination, and to compare its appearance, hardness, &c., with that produced by one or more of the needles. When the two are similar, the quality is considered to be the same. They are then further examined by moistening the stroke with aquafortis when red hot, when the appearances resulting from oxidation, etc., differ according to the nature and quantity of the alloy.

3191. Assay of Gold by Cupellation. This process is divided into five operations.

Cupellation. Either 6 or 12 grains of the alloy is the weight usually taken for the assay, to which is added 16 parts of lead for every 1 part of copper that it is presumed to contain, though considerably more lead may be used when the sample does not contain any silver; but if the reverse be the case, an excess of lead would tend to the loss of the latter metal, which ought not to be separated until the operation of parting. When silver is present an additional allowance of lead, equal to $\frac{1}{10}$ of its weight, is made on that account. When, however, the quantity of silver is small, or is not required to be estimated, it becomes of little consequence what weight of lead is employed, so long as enough be used to carry off the base metals, at the same time that the quantity is not too large for the cupel. The sample is then submitted to cupellation. This process does not require so much care for gold as silver, as none of this metal is absorbed by the cupel, or lost by evaporation, and it will safely bear the highest heat of the furnace without injury. In other respects the operation may be conducted in exactly the same manner as for silver. (*See No.* 3206.)

Quartation. After gold has passed the cupel, it may still retain either of the other perfect metals, particularly silver. To remove the latter it undergoes the operations of quartation and parting. Quartation is performed by adding 3 parts of silver to one of the cupelled sample, and fusing them together, by which the gold is reduced to one fourth of the mass, or even less; hence the name. In this state nitric acid will dissolve out the silver, which brings us to the next operation. In many cases the operation of quartation is performed conjointly with that of cupellation.

Parting. The alloy of gold and silver formed by quartation is next hammered or rolled out into a thin strip or leaf, curled up into a spiral form, and submitted to the action of nitric acid, specific gravity 1.3, diluted with half its weight of water; this being poured off, another quantity of acid, of about 1.26, and undiluted, may be employed. In each case the acid should be boiled upon the alloy for about a quarter of an hour. In the first case the quantity of fluid should be about 2½ ounces, and in the second 1½ ounces. The second part of the operation of parting is called the *reprise.* If the acid be used too strong it leaves the gold in a state of powder, otherwise the metal preserves its form throughout the process of parting. It is next carefully collected, washed, and dried.

Annealing. The sample of pure gold has now only to be annealed, which is done by putting it into a small porous crucible, and heating it to redness in the muffle.

Weighing. The pure gold is next accurately weighed. This weight doubled (if 12 grains are under assay), or quadrupled (if 6 grains), gives the number of carats fine of the alloy examined, without calculation. The loss of weight by cupellation gives the amount of copper in the sample; that after parting, the amount of silver, deducting, of course, the weight of silver used in the process, which is called the *witness.* When the sample contains but very little gold, the dry method of assaying cannot be depended on, and chemical analysis must be had recourse to. (*Cooley.*)

3192. Assay of Gold by Chemical Analysis. The richness of gold in any substance, whether liquid or solid, especially where the quantity is small, is most easily obtained by chemical analysis. The gold is thrown down from its solution by adding a solution of protosulphate of iron; the precipitate, after being washed, dried and gently heated, may be weighed as pure gold.

If 100 grains of the substance or liquid under test be taken for examination, the weight in grains of the dried precipitate will give the percentage of gold contained in the sample.

3193. To Obtain Gold Chemically Pure. Dissolve gold in nitromuriatic acid (a mixture of 1 part nitric acid with 2 parts muriatic acid, and called aqua regia); by adding to the gold solution a solution of protosulphate of iron, the pure gold is precipitated in the form of a brown powder, which should be thoroughly washed to free it from acid, and then dried. In this form it is ready to mix by fusion with other metals; or the powder can be reduced to solid metallic form by melting in a crucible, with a charcoal fire, sprinkling occasionally into the crucible a little saltpetre and potash as a flux. The gold will form a button at the bottom.

3194. Grain Gold. Cupelled gold, 1 part; silver, 3 parts; melt and pour in a small stream into water; dissolve out the silver with nitric acid, and heat the grains to redness. Used to make preparations of gold.

3195. Liquid Gold. Agitate ether with a solution of terchloride of gold for some time, allow it to repose, and decant the supernatant portion. Naphtha and essential oils possess the same property as ether, of taking gold from its solutions. This liquid was formerly held in great esteem as a cordial medicine. It is now only employed for writing on steel, gilding, &c. As it dries, it leaves a coating of pure gold. (*See No.* 3585.)

3196. To Make Watch Hands Red. Mix to a paste over a lamp, 1 ounce carmine, 1 ounce chloride of silver, and ½ ounce tinners' japan. Put some of the paste on the hands, and lay them face upwards on a sheet of copper, holding it over a spirit lamp until the desired color appears on them.

3197. French Method for Coloring Gold. A solution is made of 2 parts nitre, 1 part Roman alum, and 1 of sea salt. The jewels or articles of gold are kept in the solution at a boiling point for from 15 to 25 minutes; and then washed in water. The surface of the gold is dull, but perfectly uniform, and ready for burnishing.

3198. To Color Gold. Take 1 part salt, 1 part alum, and 2 parts saltpetre; each material to be well pounded separately in a mortar; put them into an iron pot with ½ pint water, and heat slowly over a fire; boil gently and stir with an iron rod until it rises. It is then ready for the reception of the articles to be colored, which must be not less than 18 carat fine. They are suspended in the color by 18 carat wire, and kept in motion till the liquid begins to sink, then taken out and dipped in aquafortis pickle. The color liquid will rise again, and then another dip, and sometimes two, may be necessary to give the articles the proper color. This process of coloring is no more than taking from the surface the inferior metals, leaving a thin coating of pure gold; its application should not be too long continued, as it also dissolves a small portion of the gold.

3199. Gold Coloring Solution. Take 1 ounce nitrate of soda, and ½ ounce chloride of sodium, and dissolve in a slight excess of warm water, afterwards adding to the solution about 5 drachms hydrochloric acid. The solution should be kept boiling while the work is in it.

3200. To Clean Gold after it is Soldered. Put it through the same process as silver (*see No.* 3222), but, instead of alum-water, boil it in wine and sal-ammoniac.

3201. To Restore the Color of Gold after Soldering. Boil the gold, after soldering, in diluted oil of vitriol; rinse in clean water, polish with Tripoli mixed in oil (sweet oil is best), wash and gloss with crocus on a clean cloth.

3202. To Clean Gold. Dissolve a little muriate of ammonia in urine; boil your soiled gold therein, and it will become clean and brilliant.

3203. To Clean Gold Ornaments. Gold ornaments may also be thoroughly cleaned by immersion for a few seconds in a weak solution of ammonia. Then wash with soap and water.

3204. Polishing Powder for Gold Articles. Dr. W. Hofman has analyzed a polishing powder sold by gold workers in Germany, which always commands a very high price, and hence, it may be inferred, is well adapted for the purpose. He found it to be a very simple composition, being a mixture of about 70 per cent. sesquioxide of iron (iron rust) and 30 per cent. sal-ammoniac. To prepare it, protochloride of iron, obtained by dissolving iron in hydrochloric acid, is treated with liquid ammonia until a precipitate is no longer formed. The precipitate is collected on a filter, and, without washing, is dried at such a temperature that the adhering sal-ammoniac shall not be volatilized. The protoxide of iron precipitate at first becomes charged with sesquioxide.

Silver. This metal has a very white color, a high degree of lustre, is exceedingly malleable and ductile, and the best conductor of heat and electricity known. It is procured from its ores chiefly by amalgamation and cupellation. Its specific gravity is 10.474, and melting-point 1873° Fahr., or bright redness. It is soluble in nitric acid, and in sulphuric acid by the aid of heat. Its surface is rapidly tarnished by sulphuretted hydrogen, and by the fumes of sulphur.

3206. Assay of Silver by Cupellation. The assay pound (usually 12 or 20 grains for silver) of the alloy for examination is accurately weighed, and then wrapped in a small piece of paper ready to undergo the process of cupellation. (*See No.* 3191.) The quantity of lead used is not uniform, but depends on the nature of the alloy. It should be 16 times the weight of the copper presumed to be present in the sample. This, however, cannot be accurately ascertained, though an experienced assayer is generally able to guess very nearly the amount. If too much lead be used, the button obtained by cupellation will be too small, owing to some of the silver being absorbed by the cupel; and if too little be used, the button will come out too large, from still containing some copper. The importance of justly proportioning the lead to the quantity of copper present in the alloy, cannot be too much insisted on. (*Cooley*).

3207. Assay of Silver by Chemical Analysis. Dissolve 10 grains of the alloy in 100 grains of nitric acid, specific gravity 1.28, by the aid of heat; the solution being made in a tall stoppered glass tube, furnished with a foot; then place it in a very delicate balance, which must be brought into an exact state of equilibrium, and add the test solution (*see No.* 3208) gradually and cautiously, until the whole of the silver be thrown down; but the utmost care must be taken not to exceed this point. The number of grains now required to restore the equilibrium of the scales gives the exact quantity of pure silver present in 1000 parts of the sample. The addition of the test liquor to the solution requires the utmost exactness. After each addition the stopper should be placed in the tube, and the latter violently agitated for a short time, when the liquor will rapidly clear and enable it to be seen when the operation is concluded. We must then, as a check, add a small quantity of a solution of nitrate of silver to the liquor in the tube, after having first carefully taken the weight. If too much of the test liquor has been added, this will produce a fresh precipitate, and the assay cannot then be depended on. Instead of weighing the quantity of test liquor used, a tube graduated into 100 parts, and holding 1000 grains, may be used instead, every division of which required to throw down the silver, will represent the $\frac{1}{10}$th of a grain. The tube being filled to the 0, is ready for use, and from being graduated downward the quantity poured out may at once be read off. Generally speaking, however, measuring does not admit of the same accuracy as weighing. The termination of the operation is clearly marked, when, on adding a minute quantity of the test liquor to the silver solution, no cloudiness occurs.

3208. Test Solution for Assaying Silver. Dissolve 54¼ grains pure sea-salt (*see No.* 3209) in 22 ounces 320¾ grains (avoirdupois) distilled water. Filter and keep in a stoppered bottle for use.

3209. Pure Sea-Salt. Boil together for a few minutes, in a glass vessel, a solution of salt with a little pure bicarbonate of soda; filter; add muriatic acid until the liquor be neutral to litmus and turmeric paper; then evaporate and crystallize.

3210. To Extract Silver from Lead. This is easily done in a small way by melting the mixed metals by a strong heat in the open air. The lead will be converted into litharge, and the silver will sink to the bottom of the crucible. On a large scale, the silver is extracted from the lead by the oxidation of the lead into a reverberatory furnace of a particular construction. A shallow vessel, called a cupel, is filled with ashes, well packed and pounded down, and a cavity cut out for the reception of the nozzle of a bellows, through which air is forcibly driven. When the fire is lighted and the lead is in a state of fusion from the reverberation of the flame, the blast from the bellows is made to play forcibly on the surface, and in a short time a crust of oxide of lead or litharge is formed and driven off to the side of the cupel opposite to the mouth of the bellows, where a shallow aperture is made for it to pass over; another crust of litharge is formed and driven off, and this is repeated until nearly all the lead has been scorified and blown aside. The complete separation of the lead is indicated by the appearance of a brilliant lustre on the convex surface of the melted mass in the cupel, which is occasioned by the removal of the last crust of litharge which covered the silver. If the silver thus abstracted is not sufficiently pure, it is further refined in a reverberatory furnace, being placed in a cupel lined with bone ashes and exposed to an intense heat, so that the lead which escaped oxidation by the first process is converted into litharge, and is absorbed by the ashes of the cupel.

3211. Test for Metallic Silver. The compounds of silver, mixed with carbonate of soda, and exposed on charcoal to the inner flame of a blow-pipe, afford white, brilliant, and ductile metallic globules, without any incrustation of the charcoal. (*See also Assaying.*)

3212. To Obtain Pure Silver. Pure silver is obtained by placing a copper rod in a solution of nitrate of silver, digesting the precipitate in caustic ammonia, and washing with water; or by boiling recently precipitated and still moist chloride of silver in a bright iron vessel along with water. (*See No.* 3536.)

3213. Solvent for Silver. Nitro-sulphuric acid. Dissolve 1 part nitre in 10 parts oil of vitriol. Used for dissolving the silver from plated goods, &c. It dissolves silver at a temperature below 200°, and scarcely acts upon copper, lead, and iron, unless diluted. (*See Nos.* 3716, 3720, *and* 3721.) The silver is precipitated from the solution, after moderately diluting it, by common salt, and the chloride reduced as directed in Nos. 3214 and 3215.

3214. To Purify and Reduce Silver. Silver, as used in the arts and coinage, is alloyed with a portion of copper. To purify it, dissolve the metal in nitric acid slightly diluted, and add common salt, which throws down the whole of the silver in the form of chloride. To reduce it into a metallic state several methods are used. The chloride must be repeatedly washed with distilled water, and placed in a zinc cup; a little diluted sulphuric acid being added, the chloride is soon reduced. The silver, when thoroughly washed, is quite pure. In the absence of a zinc cup, a porcelain cup containing a zinc plate may be used. The process is expedited by warming the cup. (*See No.* 3536.)

3215. To Purify and Reduce Silver. Proceed as above, and digest the washed chloride with pure copper and ammonia. The quantity of ammonia need not be sufficient to dissolve the chloride. Leave the mixture for a day, then wash the silver thoroughly. Or: Boil the washed and moist chloride in solution of pure potash, adding a little sugar; when washed it is quite pure.

3216. Peale's Method of Obtaining Pure Silver from its Solutions. By adding in excess, a saturated solution of common salt to the solution of nitrate of silver, the metal is thrown down, as an insoluble salt, the chloride of silver. The precipitate must then be carefully washed until it is entirely freed from the presence of nitric acid. Granulated zinc must then be added to the chloride, and stirred through the mass. The finer the zinc has been granulated, the more rapid will be the reduction. Dilute sulphuric acid must also be added, and the whole stirred until the reduction is complete, which will be known by the entire disappearance of the white chloride, and its conversion into a grey powder. A new set of affinities takes place with great rapidity in this combination, and the chlorine is liberated from the silver, which takes its metallic form, as above stated, in the appearance of a grey powder. The zinc, having been added in excess, must now be removed by the addition of dilute sulphuric acid; after all action has ceased, the solution of zinc must be decanted, or drawn off with a syphon, and the silver washed until free from acidulous matter, after which it may be dried by pressure, or the simple application of heat in a pan over the fire, when it will be ready for melting, with the usual fluxes, or re-solution with nitric acid. This process is rapid and easy; is not subject to loss; it will yield, in the terms of trade, pure silver, of a quality from 994 to 998 thousandths fine, and is therefore well adapted to the preparation of pure nitrate of silver for the use of photographers and all others who need a reliable article.

3217. Silver Dust. Take silver, dissolve it in slightly diluted nitric acid, and precipitate it with slips of *bright* copper; wash the powder in spirits, and dry it. Or: An exceedingly fine silver dust may be obtained by boiling recently precipitated chloride of silver with water acidulated with sulphuric acid, and zinc.

3218. To Frost Polished Silver. To produce a frosted surface on polished silver, use cyanide of potassium with a brush. The silver should not be handled during the process, but held with pliers made of lancewood or boxwood. The proportion should be 1 ounce dissolved in ½ pint of water. It is very poisonous.

3219. To Oxidize Silver. A very beautiful effect is produced upon the surface of silver articles, technically termed oxidizing, which gives the surface an appearance of polished steel. This can be easily effected by taking a little chloride of platinum, prepared as described in the next receipt, heating the solution and applying it to the silver when an oxidized surface is required, and allowing the solution to dry upon the silver. The darkness of the color produced varies according to the strength of the platinum solution, from a light steel gray to nearly black. The effect of this process, when combined with what is termed dead work, is very pretty, and may be easily applied to medals, giving scope for the exercise of taste. The high appreciation in which ornaments in oxidized silver are now held, render a notice of the process followed interesting. There are two distinct shades in use—one produced by chloride, which has a brownish tint, and the other by sulphur, which has a blueish-black tint. To produce the former, it is only necessary to wash the article with a solution of sal-ammoniac; a much more beautiful tint may, however, be obtained by employing a solution composed of equal parts of sulphate of copper and sal-ammoniac in vinegar. The fine black tint may be produced by a slightly warm solution of sulphuret of potassium or sodium. (*Dr. Ellsner.*)

3220. To Prepare Nitro-Muriate (Chloride) of Platinum. The nitro-muriate of platinum is easily prepared: Take 1 part nitric acid, and 2 parts hydrochloric (muriatic) acid; mix together and add a little platinum; keep the whole at or near a boiling heat; the metal is then dissolved, forming the solution required.

3221. To Make a Silver Tree. Dissolve 20 grains nitrate of silver in 1 fluid ounce of water in a phial, and add ½ drachm pure mercury. Arrange the zinc as for the lead tree. Very brilliant and beautiful.

3222. To Clean Silver after it is Soldered. Make it just red hot, and let it cool; then boil it in alum water, in an earthen vessel, and it will be as clean as when new.

3223. Belgian Burnishing Powder. A burnishing powder in use in Belgium is composed of ½ pound fine chalk, 3 ounces pipe clay, 2 ounces white lead, ¾ ounce magnesia (carbonate), and the same quantity of jeweler's rouge.

3224. To Protect Silver-Ware from Tarnishing. The loss of silver which results from the impregnation of our atmosphere with sulphur compounds, especially where gas is burned, is very great. Silversmiths may thank one of their confraternity—Mr. Strolberger, of Munich—for a happy thought. He seems to have tried various plans to save his silver, if possible. He covered his goods with a clear white varnish, but found that it soon turned yellow in the window, and spoiled the look of his wares. Then he tried water-glass (solution of silicate of potash), but this did not answer. He tried some other solutions, to no purpose; but at last he hit upon the expedient of coating his goods over with a thin coating of collodion, which he found to answer perfectly. No more loss of silver, and no longer incessant labor in keeping it clean. The plan he adopts is this: He first warms the articles to be coated, and then paints them over carefully with a thinnish collodion diluted with alcohol, using a wide soft brush for the purpose. Generally, he says, it is not advisable to do them over more than once. Silver goods, he tells us, protected in this way, have been exposed in his window more than a year, and are as bright as ever, while others unprotected have become perfectly black in a few months.

3225. To Prevent Coins and Small Ornaments from Tarnishing. All ornaments, whether gold or silver, can be kept from tarnishing if they are carefully covered from the air in box-wood sawdust, which will also dry them after being washed. The tarnish on silver-ware is most often due to sulphur. A gentleman who wears a silver watch finds that it is tarnished from the sulphur fumes of the rubber ring which holds together his ferry tickets. Sulphur fumes enough get into the air to account for all ordinary cases of tarnishing.

3226. To Clean Silver. Immerse for half an hour the silver article into a solution made of 1 gallon water, 1 pound hyposulphite of soda, 8 ounces muriate of ammonia, 4 ounces liquid ammonia, and 4 ounces cyanide of potassium; but, as the latter substance is poisonous, it can be dispensed with if necessary. The article, being taken out of the solution, is washed, and rubbed with a wash leather.

3227. To Clean Silver Plate. Fill a large saucepan with water; put into it 1 ounce carbonate of potash and ¼ pound whiting. Now put in all the spoons, forks, and small plate, and boil them for 20 minutes; after which take the saucepan off the fire and allow the liquor to become cold; then take each piece out and polish with soft leather. A soft brush must be used to clean the embossed and engraved parts.

3228. Plate Boiling Powder. Mix equal parts of cream of tartar, common salt, and alum. A little of this powder, added to the water in which silver-plate is boiled, gives to it a silvery whiteness.

3229. Plate Cleaning Powder. For cleaning silver and plated articles, &c. Mix ¼ pound jeweler's rouge with ¾ pound prepared chalk. Or: ¼ pound levigated putty powder, ½ pound burnt hartshorn, 1 pound prepared chalk, and 1 ounce rose-pink.

3230. To Clean Silver. To clean silver, mix 2 tea-spoonfuls of ammonia in a quart of hot soap-suds. Put in the silver-ware and wash it, using an old nail-brush or tooth-brush for the purpose.

3231. To Clean Silver and Silver Plated Articles. Boil 1 ounce finely powdered and calcined hartshorn in 1 quart water, and while on the fire, insert the articles, as many as the vessel will hold; leave them in a short time, then take them out, and dry them over a fire; when all the articles have been thus treated, put into the solution clean woolen rags; when they are saturated, hang them up to dry. These will be excellent for polishing the silver, as well as for cleaning brass door-knobs, &c.

3232. To Preserve the Polish on Silver. Wash it twice a week (if in daily use) with *soft* soap and hot water, and polish with Canton flannel. (*See next receipt.*)

3233. To Clean Silver Ornaments. Boil them in soft soap and water for five minutes; then put them in a basin with the same hot soap and water, and scrub them gently with a very soft brush while hot; then rinse and dry with a linen rag. Heat a piece of common unglazed earthenware, or a piece of brick or tile in the fire; take it off, and place the ornaments upon it for the purpose of drying them, and causing every particle of moisture to evaporate; as the moisture, which otherwise would remain on the silver, will cause it to tarnish, or assume a greenish hue.

3234. To Clean Silver. Moisten some finely powdered whiting or Paris white with spirits of hartshorn, rub the silver into it, let it dry, then rub it off with a soft cloth and polish it with chamois leather. Some kinds of silver soap keep silver looking nicely, but many of them are chemical compounds that injure the silver.

3235. To Clean Silver Plate. Whiting finely powdered and moistened with a little sweet oil is excellent to clean silver. Let the mixture dry on, then rub it off with a soft linen cloth and polish with chamois leather. This gives silver a beautiful white appearance, and if well done the silver will keep clean a long time.

3236. To Remove Ink Stains from Silver. The tops and other portions of silver inkstands frequently become deeply discolored with ink, which is difficult to remove by ordinary means. It may, however, be completely eradicated by making a little chloride of lime into a paste with water, and rubbing it upon the stains.

3237. To Remove Dark Stains from Silver. A certain remedy for the most inveterate stains that are sometimes to be seen on teaspoons and other silver ware, is to pour a little sulphuric acid into a saucer, wet with it a soft linen rag, and rub it on the blackened silver till the stain disappears. Then coat the articles with whiting finely powdered and sifted, and mixed with whiskey or spirits of wine. When the whiting has dried on, and rested a quarter of an hour or more, wipe it with a silk handkerchief, and polish with a soft buckskin.

3238. To Remove Egg Stains from Spoons. To remove the stains on spoons, caused by using them for boiled eggs, take a little common salt moist between the thumb and finger, and briskly rub the stain, which will soon disappear. Then wash.

3239. To Clean Gold, Silver, and Copper Coin for Numismatic Collections. Make a weak solution of cyanide of potassium and bathe the coin in it for 2 or 3 seconds, then immediately wash it with a *very fine* brush, in soap-suds; rinse in clean cold water, and dry in boxwood saw dust. This receipt is particularly good for fine proof coins. Be careful not to let the coins remain in the solution longer than the time specified, otherwise they may have a frosted appearance. (*See No.* 2167.) As the cyanide of potassium is a very deadly poison, great care must be taken by the operator not to use it unless his hands are entirely free from scratches. This solution may also be used for cleaning fine copper coins, but care must be taken not to use the mixture that has previously been employed for cleaning silver, or a coating of the latter metal may be the consequence. (*See Nos.* 3224 *and* 3225.)

Silver coins are often covered with a dense green oxide. To remove this they should be steeped for 10 minutes in a solution of ammonia, then immersed in water and wiped with a soft towel; if necessary, a fresh quantity of the solution may be applied. Copper coin may be cleaned by immersing in pure sweet oil and wiping dry with a soft rag.

Copper. This metal is found in the metallic state, and in combination with oxygen, sulphur, acids, and other minerals, and in the organic kingdom, in the ashes of plants, and in the blood of animals. The copper of commerce is principally prepared from copper pyrites, a mixed sulphuret of iron and copper, found in Cornwall and other parts of the world. Copper is only prepared from its ores on the large scale. The copper pyrites are first roasted, and then smelted, by which process *coarse metal* is produced; this is again submitted to calcination and smelting, when *fine metal* is obtained. It afterwards undergoes the process of refining and toughening. This metal is malleable and ductile. It has a specific gravity of 8.8 to 8.9, fuses at about 2000° Fahr., and volatilizes at higher temperatures. It is easily soluble in nitric acid, and is attacked more or less rapidly by acids in general. It forms numerous compounds, all of which are more or less poisonous. Exposure to a damp atmosphere produces on its surface a green colored oxide, known as *verdigris*. Copper may be readily alloyed with other metals, except iron and lead, with which it unites with difficulty.

3241. Test for the Quantity of Copper in a Compound. The quantity of copper present in any compound may be estimated by throwing it down from its solution by pure potassa, after which it must be carefully collected, washed, dried, ignited, and weighed. This will give the quantity of the oxide from which its equivalent of metallic copper may be calculated; every 5 parts of the former being nearly equal to 4 of the latter; or, more accurately, every 39.7 parts are equal to 31.7 of pure metallic copper. Copper may also be precipitated at once in the metallic state, by immersing a piece of polished steel into the solution; but this method will not give very accurate results.

3242. To Separate Lead from Copper. Copper may be separated from lead by adding sulphuric acid to the nitric solution, and evaporating to dryness, when water digested on the residuum will dissolve out the sulphate of copper, but leave the sulphate of lead behind. From this solution the oxide of copper may be thrown down as before.

3243. To Separate Zinc from Copper. Copper may be separated from zinc by sulphuretted hydrogen, which will throw down a sulphuret of copper, which may be dissolved in nitric acid, and treated as in last receipt.

3244. To Separate Tin from Copper. Digest in nitric acid; the copper will be dissolved, but the tin will remain in an insoluble peroxide.

3245. To Separate Silver from Copper. Digest, in a state of filings or powder, in a solution of chloride of zinc, which dissolves the copper and leaves the silver unchanged.

3246. To Separate Copper from its Alloys. Copper may be separated in absolute purity from antimony, arsenic, bismuth, lead, iron, &c., as it exists in bell-metal, brass, bronze, and other commercial alloys, by fusing, for about half an hour, in a crucible, 10 parts of the metal with 1 part each of copper scales (black oxide), and bottle glass. The pure copper is found at the bottom of the crucible, whilst the other metals or impurities are either volatilized or dissolved in the flux.

3247. Copper in Fine Powder. A solution of sulphate of copper is heated to the boiling-point, and precipitated with sublimated zinc. (*See No.* 30.) The precipitated copper is then separated from the adherent zinc by diluted sulphuric acid, and dried by exposure to a moderate temperature.

3248. Reduction of Copper in Fine Powder. M. Schiff gives the following process for obtaining copper in a state of fine division: A saturated solution of sulphate of copper, together with some crystals of the salt, are introduced into a bottle or flask, and agitated with some granulated zinc. The zinc displaces the copper from its solution, fresh sulphate dissolving as the action goes on, until the whole is exhausted. Heat is disengaged during the operation. The precipitated copper must be washed and dried as rapidly as possible, to prevent oxidation.

3249. Feather-Shot Copper. Melted copper, poured in a small stream into cold water. It forms small pieces, with a feathered edge, hence the name. It is used to make solution of copper.

3250. Welding Copper. A compound of 358 parts phosphate of soda and 124 parts boracic acid is prepared, and is used when the metal is at a dull red heat; the heat is then increased till the metal becomes of a cherry red color, and the latter is at once hammered. A hammer of wood is recommended for this purpose, as the metal is liable to soften at a high heat; and the hammer should be used cautiously. All scale and carbonaceous matter must be removed from the surface of the copper, as the success of the welding depends on the formation of an easily fusible phosphate of copper, which would be reduced to a phosphide by the presence of carbon.

3251. To Prevent the Corrosion of Copper and Other Metals. The best means of preventing corrosion of metals is to dip the articles first into a very dilute nitric acid, immerse them afterwards in linseed oil, and allow the excess of oil to drain off. By this process metals are effectually prevented from rust or oxidation.

3252. To Clean Coppers and Tins. These are cleaned with a mixture of rotten stone, soft soap, and oil of turpentine, mixed to the consistency of stiff putty. The stone should be powdered very fine and sifted; and a quantity of the mixture may be made sufficient to last for a long while. The articles should first be washed with hot water, to remove grease. Then a little of the above mixture, mixed with water, should be rubbed over the metal; then rub off briskly, with dry clean rag or leather, and a beautiful polish will be obtained. When tins are much blackened by the fire they should be scoured with soap, water, and fine sand.

Lead. Lead is only prepared on the large scale. It is usually extracted from *galena*, a natural sulphuret of lead, by roasting the ore in a reverberatory furnace, and afterwards smelting it along with coal and lime. Its specific gravity, in a state of absolute purity, is 11.38 to 11.44, but ordinary lead seldom exceeds 11.35. It melts at about 612° Fahr., and when very slowly cooled, crystallizes in octohedrons. It is malleable and ductile, but devoid of elasticity. Lead is not dissolved by muriatic, sulphuric, or the vegetable acids, unless by free contact with air, and then very slowly: but nitric acid rapidly oxidizes it, forming a solution of nitrate of lead. Pure water, put into a leaden vessel, and exposed to the air, soon corrodes it, and dissolves the newly-formed oxide; but river and spring water exert no such influence, the carbonates and sulphates in such water destroying its solvent power. Lead may be alloyed with most metals, except those which differ greatly from it in specific gravity and melting point. It has a strong affinity for gold and silver, and is therefore employed to separate those metals, by cupellation, from other metals and minerals.

3254. Cautions on the Use of Lead for Cisterns, &c. Ordinary water, which abounds in mineral salts, may be safely kept in leaden cisterns; but distilled and rain water, and water that contains scarcely any saline matter, speedily corrode, and dissolve a portion of lead, when kept in vessels of that metal. When, however, leaden cisterns have iron or zinc fastenings or braces, a galvanic action is set up, the preservative power of saline matter ceases, and the water speedily becomes contaminated with lead. Water containing free carbonic acid also acts on lead; and this is the reason why the water of some springs, kept in leaden cisterns, or raised by leaden pumps, possesses unwholesome properties. Free carbonic acid is evolved during the fermentation or decay of vegetable matter, and hence the propriety of preventing the leaves of trees falling into water-cisterns formed of lead.

3255. To Test the Richness of Lead Ores. Lead ores, or galena, may be tested in different ways. The *wet way* is as follows: Digest 100 grains of the ore in sufficient nitric acid diluted with a little water, apply heat to expel any excess of acid, and largely dilute the remainder with distilled water. Next add dilute hydrochloric acid, by drops, as long as it occasions a precipitate, and filter the whole, after being moderately heated, upon a small paper filter. Treat the filtered liquid with a stream of sulphuretted hydrogen; collect the black precipitate, wash it, and digest it in strong nitric acid; when entirely dissolved, precipitate the lead with sulphuric acid dropped in it, evaporate the precipitate to dryness, the excess of sulphuric acid being expelled by a rather strong heat applied towards the end. The dry mass should be washed, dried, and exposed to slight ignition in a porcelain crucible. The resulting dry sulphate is equal to .68 per cent. of its weight in lead.

3256. To Find the Percentage of Lead in Lead Ores. This can be done by applying the test in the *wet way* (*see No.* 3255), and multiplying the weight of the product obtained in grains by .68. It may also be found in the *dry way*, as follows: Plunge a conical wrought iron crucible into a blast furnace, raised to as high a heat as possible; when the crucible has become of a dull red heat, introduce into it 1000 grains galena (lead ore) reduced to powder, and stir it gently with a piece of stiff iron wire flattened at the end. This wire must never be suffered to get red hot. To prevent the ore from adhering, after 3 or 4 minutes, cover up the crucible; and when at a full cherry-red heat, add 2 or 3 spoonfuls of reducing flux (*see No.* 3464), and bring to a full white heat; in 12 to 15 minutes, after having scraped down the scoria, etc., from the sides of the crucible, into the melted mass, the crucible should be removed from the fire, and the contents tilted into a small brass mould, observing to run out the metal free from scoria, by raking the latter back with a piece of green wood. The scoria is then reheated in the crucible with ½ spoonful of flux, and this second reduction added to the first. The weight in grains of the metal obtained, divided by 10, gives the percentage of metallic lead in the sample of ore.

3257. To Make a Lead Tree. Dissolve 1 ounce sugar of lead (acetate of lead) in 1½ pints distilled water; add a few drops of acetic acid; place the liquid in a clear white glass bottle and suspend a piece of zinc in it by means of a fine thread secured to the cork.

Iron.

Iron is only prepared on the large scale. It is obtained by smelting the ore along with coke and a flux (either limestone or clay). The crude iron thus obtained is run into moulds, and then constitutes *cast iron or pig iron.* By the subsequent process of refining, (puddling, welding,) it is converted into *soft iron or wrought iron.* The properties and uses of iron are too well known to require description. Its applications in almost every branch of human industry are almost infinite. It is remarkably ductile, and possesses great tenacity, but it is less malleable than many of the other metals. Its specific gravity is 7.788, and melts at about 2700° Fahr. It is the hardest of all of the malleable and ductile metals, and when combined with carbon or silica (steel), admits of being tempered to almost any degree of hardness or elasticity. Metallic iron is distinguished by being attracted by the magnet; by being dissolved by dilute muriatic and sulphuric acids, with solution of hydrogen gas, recognized by its inflammability; and the solution exhibits the usual reactions of protoxide of iron. (*Cooley.*) Iron does not alloy easily with other metals, principally on account of its high melting point. It is easily attacked by acids, and requires protection from the air, to prevent oxidization or rusting.

3259. To Estimate the Percentage of Iron in Ores. Prepare a crucible of refractory clay by pressing into it successive layers of moistened powdered charcoal until full and solid; clear out a cavity by removing the central portion. Take 200 grains of the powdered ore, and mix it with the same weight of dry slacked lime, and 50 grains charcoal; if necessary a litte carbonate of soda may be used with very refractory ores; introduce this mixture into the crucible and lute it up. Expose the crucible to a moderate heat until the contents of the crucible are dry, then apply, and maintain for half an hour the full heat of a blast furnace. Then remove the crucible, tap it steadily on the edge of the furnace, so as to bring the metallic portion of its contents together at the bottom; and, when cool, break the crucible open. The iron will be found in a clean button at the bottom of the slag. Clean the iron with a scratch brush, and weigh it. Its weight, divided by 2, will give the percentage of richness of the ore under examination.

3260. To Distinguish Wrought and Cast Iron from Steel. Elsner produces a bright surface by polishing or filing, and applies a drop of nitric acid, which is allowed to remain there for one or two minutes, and is then washed off with water. The spot will then look a pale ashy gray on wrought iron, a brownish black on steel, a deep black on cast iron. It is the carbon present in various proportions which produces the difference in appearance.

3261. To Impart to Cast Iron the Appearance of Bronze. The article to be so treated is first cleaned with great care, and then coated with a uniform film of some vegetable oil; this done, it is exposed in a furnace to the action of a high temperature, which, however, must not be strong enough to carbonize the oil. In this way the cast iron absorbs oxygen at the moment the oil is decomposed, and there is formed at the surface a thin coat of brown oxide, which adheres very strongly to the metal, and will admit of a high polish, giving it quite the appearance of the finest bronze.

3262. Brown Tint for Iron and Steel. Dissolve in 4 parts of water, 2 parts crystallized chloride of iron, 2 parts chloride of antimony, and 1 part gallic acid, and apply the solution with a sponge or cloth to the article, and dry it in the air. Repeat this any number of times according the depth of color which it is desired to produce. Wash with water, and dry, and finally rub the articles over with boiled linseed oil. The metal thus receives a brown tint and resists moisture. The chloride of antimony should be as little acid as possible.

3263. To Blue Gun Barrels. Apply nitric acid and let it eat into the iron a little; then the latter will be covered with a thin film of oxide. Clean the barrel, oil, and burnish.

3264. To Ornament Gun Barrels. A very pretty appearance is given to gun barrels by treating them with dilute nitric acid and vinegar, to which has been added sulphate of copper. The metallic copper is deposited irregularly over the iron surface. Wash, oil, and rub well with a hard brush.

3265. Iron Filings. The only way to obtain them pure, is to act on a piece of soft iron with a file.

3266. To Remove Rust from Iron. We have never seen any iron so badly scaled or incrusted with oxide, that it could not be cleaned with a solution of 1 part sulphuric acid in 10 parts water. Paradoxical as it may seem, strong sulphuric acid will not attack iron with anything like the energy of a solution of the same. On withdrawing the articles from the acid solution they should be dipped in a bath of hot lime water, and held there till they become so heated that they will dry immediately when taken out. Then, if they are rubbed with dry bran or sawdust, there will be an almost chemically clean surface left, to which zinc will adhere readily.

3267. To Keep Polished Iron Work Bright. Common resin melted with a little gallipoli oil and spirits of turpentine has been found to answer very well for preserving polished iron work bright. The proportions should be such as to form a coating which will adhere firmly, not chip off, and yet admit of being easily detached by cautious scraping.

3268. To Protect Iron from Oxidization. Among the many processes and preparations for preserving iron from the action of the atmosphere, the following will be found the most efficient in all cases where galvanization is impracticable; and, being unaffected by sea water, it is especially applicable to the bottoms of iron ships, and marine work generally: Sulphur, 17 pounds; caustic potash lye of 35° Baumé, 5 pounds; and copper filings, 1 pound. To be heated until the copper and sulphur dissolve. Heat, in another vessel, tallow, 750 pounds, and turpentine, 150 pounds, until the tallow is liquefied. The compositions are to be mixed and stirred together while hot, and may be laid on to the iron, in the same way as paint.

3269. To Protect Iron from Rust. A mastic or covering for this purpose, proposed by M. Zeni, is as follows: Mix 80 parts pounded brick, passed through a silk sieve, with 20 parts litharge; the whole is then rubbed up by the muller with linseed oil, so as to form a thick paint, which may be diluted with spirits of turpentine. Before it is applied the iron should be well cleaned. From an experience of 2 years upon locks exposed to the air, and watered daily with salt water, after being covered with 2 coats of this mastic, the good effects of it have been thoroughly proved.

3270. To Prevent the Decay of Iron Railings. Every one must have noticed the destructive combination of lead and iron, from railings being fixed in stone with the former metal. The reason for this is, that the oxygen of the atmosphere keeps up a galvanic action between the two metals. This waste may be prevented by substituting zinc for lead, in which case the galvanic influence would be inverted; the whole of its action would fall on the zinc; the one remaining uninjured, the other nearly so. Paint formed of the oxide of zinc, for the same reason preserves iron exposed to the atmosphere infinitely better than the ordinary paint composed of the oxide of lead.

3271. To Scour Cast Iron, Zinc, or Brass. Cast iron, zinc, and brass surfaces can be scoured with great economy of labor, time and material, by using either glycerine, stearine, naphthaline, or creosote, mixed with dilute sulphuric acid.

3272. To Clean Steel and Iron. Make 1 ounce soft soap and 2 ounces emery into a paste; rub it on the article with wash-leather and it will have a brilliant polish. Kerosene oil will also clean steel.

Steel. The addition of a small quantity of carbon greatly increases the hardness and tenacity of iron, and converts it into steel. The amount of carbon to be added, should be just that which will produce the maximum of hardness and toughness, without rendering it brittle; ordinary steel contains about 1 per cent. of carbon; hard steel 1.6 to 1.7 per cent. The percentage of carbon in English steel is estimated by Berthier to be 1.87. It melts at about 2500° Fahr.

3274. To Convert Iron into Steel. This is usually done by the process of *cementation*, producing what is termed *blistered steel.* At the bottom of a trough about 2 feet square and 14 feet long, usually formed of fire clay, is placed a layer, about 2 inches thick, of a cement composed of 10 parts charcoal and 1 part ashes and common salt; upon this is laid a tier of thin iron bars about ½ inch apart; between and over them, a layer of cement is spread, then a second row of bars, and so on, alternately, until the trough is nearly full; lastly a layer of cement covered with moist sand and a close cover of fire-tiles, so as to exclude the air. The trough is exposed to the heat of a coal fire, until a full red heat, about 2000° Fahr., is obtained and kept up steadily for about 7 days. A hole is left in the end of the trough, to allow of a bar being drawn out for examination. When a bar, on being withdrawn and broken, has acquired a crystalline texture, the metal is allowed to cool down gradually, some days being allowed for this, and the charge, when cool, withdrawn from the trough. The bars will be found covered with large blisters, hence the name of the process, and increased about $\frac{1}{180}$ in weight. The steel is now sufficiently good for files and coarser tools, but for finer instruments, several varieties of finer steel are required. (*Makins*).

3275. To Make Shear-Steel. This is produced by cutting up bars of *blistered* steel, into lengths of 30 inches, and binding them in bundles of 8 or 9 by a ring of steel, a rod being fixed for a handle. These are brought to a welding heat, and welded together under a tilt hammer. The binding ring is then removed; and, after reheating, the mass is forged solid, and extended into a bar. In cases where this operation is repeated, the steel is called *double-shear steel.* (*Makins.*)

3276. To Make Cast-Steel. Cast-steel is the best variety for all fine cutting tools. This is a mixture of scraps of different varieties of *blistered* steel, collected together in a good refractory clay crucible; upon this a cover is luted, and it is exposed to an intense heat in a blast furnace for 3 or 4 hours. The contents are then run into moulds. After being subjected to the blows of a tilt-hammer, the cast steel is ready for use. (*Makins*).

3277. Steel Made from Iron Scraps. Take iron scraps in small pieces, put 40 pounds in a crucible, with 8 ounces charcoal, and 4 ounces black oxide of manganese; expose the whole 1½ hours to a high heat, and run into moulds.

3278. To Blue Steel. The mode employed in blueing steel is merely to subject it to heat. The dark blue is produced at a temperature of 600°, the full blue at 500°, and the blue at 550°. The steel must be finely polished on its surface, and then exposed to a uniform degree of heat. Accordingly, there are three ways of coloring: first, by a flame producing no soot, as spirit of wine; secondly, by a hot plate of iron; and thirdly, by wood ashes. As a very regular degree of heat is necessary, wood ashes for fine work bear the preference. The work must be covered over with them, and carefully watched; when the color is sufficiently heightened, the work is perfect. This color is occasionally taken off with a very dilute muriatic acid.

3279. To Blue Small Steel Articles. Make a box of sheet iron, fill it with sand, and subject it to a great heat. The articles to be blued must be finished and well polished. Immerse the articles in the sand, keeping watch of them until they are of the right color, when they should be taken out, and immersed in oil.

3280. To Make Edge-Tools from Cast-Steel and Iron. This method consists in fixing a clean piece of wrought iron, brought to a welding heat, in the centre of a mould, and then pouring in melted steel, so as entirely to envelop the iron; and then forging the mass into the shape required.

3281. To Remove Scale from Steel. Scale may be removed from steel articles by pickling in water with a little sulphuric acid in it, and when the scale is loosened, brushing with sand and a stiff brush.

3282. To Restore Burnt Cast-Steel. Take 1½ pounds borax, ½ pound sal-ammoniac, ¼ pound prussiate of potash, 1 ounce resin. Pound the above fine, add a gill each of water and alcohol. Put in an iron kettle, and boil until it becomes a paste. Do not boil too long, or it will become hard on cooling.

3283. To Anneal Steel. For a small quantity. Heat the steel to a cherry red in a charcoal fire, then bury it in sawdust, in an iron box, covering the sawdust with ashes. Let it stay until cold. For a larger quantity, and when it is required to be very soft, pack the steel with cast-iron (lathe or planer) chips in an iron box, as follows: Having at least ½ or ¾ inch in depth of chips in the bottom of box, put in a layer of steel, then more chips to fill spaces between the steel, and also the ½ or ¾ inch space between the sides of box and steel, then more steel; and, lastly, at least 1 inch in depth of chips, well rammed down on top of the steel. Heat to and keep at a red heat for from 2 to 4 hours. Do not disturb the box until cold.

3284. Engraving Mixture for Writing on Steel. Sulphate of copper, 1 ounce; sal-ammoniac, ½ ounce; pulverize separately, adding a little vermilion to color it, and mix with 1½ ounces vinegar. Rub the steel with soft soap and write with a clean hard pen, without a slit, dipped in the mixture.

3285. Tempering Tools. The steel is generally first hardened by heating it to a cherry red, and then plunging it into cold water. Afterward the temper is drawn by moderately heating the steel again. Different degrees of hardness are required for different purposes.

For very pale straw color, 430°, for lancets.

A shade of darker yellow, 450°, for razors and surgical instruments.

Darker straw yellow, 470°, for pen-knives.

Still darker yellow, 490°, chisel for cutting iron.

Brown yellow, 500°, axes and plane-irons.

Yellow, slightly tinged with purple, 520°, table-knives and watch-springs.

3286. To Temper Drills. Heat the best steel to a cherry red, and hammer until nearly cold, forming the end into the requisite flattened shape, then heat it again to a cherry red, and plunge it into a lump of resin or into quicksilver. A solution of cyanide of potassium in rain water is sometimes used for the tempering plunge bath, but it is not as good as quicksilver or resin.

3287. To Temper Gravers. These may be tempered in the same way as drills; or the red hot instrument may be pressed into a piece of lead, in which a hole about ½ an inch deep has been cut to receive the graver; the lead melting around and enclosing it will give it an excellent temper.

3288. To Temper Spiral Springs. Heat to a cherry red in a charcoal fire, and harden in oil. To temper, blaze off the oil 3 times, the same as for flat springs.

3289. To Temper Old Files. Grind out the cuttings on one side, until a bright surface is obtained; then damp the surface with a little oil, and lay the file on a piece of red-hot iron, bright side upwards. In about a minute the bright surface will begin to turn yellow; and when the yellow has deepened to about the color of straw, plunge in cold water.

3290. To Make Polished Steel Straw Color or Blue. The surface of polished steel acquires a pale straw color at 460° Fahr., and a uniform deep blue at 580° Fahr.

3291. To Temper Mill Picks. After working the steel carefully, prepare a bath of lead heated to the boiling point, which will be indicated by a slight agitation of the surface. In it place the end of the pick to the depth of 1½ inches, until heated to the temperature of the lead, then plunge immediately in clear cold water. The temper will be just right, if the bath is at the temperature required. The principal requisities in making mill picks are: First, get good steel. Second, work it at a low heat; most blacksmiths injure steel by overheating. Third, heat for tempering without direct exposure to the fire. The lead bath acts merely as protection against the heat, which is almost always too great to temper well.

3292. Bath for Hardening Mill Picks. Take 2 gallons rain water, 1 ounce corrosive sublimate, 1 of sal-ammoniac, 1 of saltpetre, 1½ pints rock salt. The picks should be heated to a cherry red, and cooled in the bath. The salt gives hardness, and the other ingredients toughness to the steel; and they will not break, if they are left without drawing the temper.

3293. Composition for Tempering Cast-Steel Mill Picks. To 3 gallons of water, add 3 ounces each nitric acid, spirits of hartshorn, sulphate of zinc, sal-ammoniac, and alum; 6 ounces salt, with a double handful of hoof-parings; the steel to be heated a dark cherry red. It must be kept corked tight to prevent evaporation.

3294. Tempering Steel. Mr. N. P. Ames, late of Chicopee, Mass., after expending much time and money in experiments, found that the most successful means of tempering swords and cutlasses that would stand the United States Government test, was by heating in a charcoal fire, hardening in pure spring water, and drawing the temper in charcoal flame. (*See No.* 3285.)

3295. To Straighten Hardened Steel. To straighten a piece of steel already hardened and tempered, heat it lightly, not enough to draw the temper, and you may straighten it on an anvil with a hammer, if really not dead cold. It is best, however, to straighten it between the centres of a lathe, if a turned article, or on a block of wood with a mallet. Warm, it yields readily to the blows of the mallet, but cold, it would break like glass.

3296. To Restore the Power of Horseshoe Magnets. To restore horseshoe magnets that have lost their power from disuse, proceed as with new ones. Place the poles of the magnet to be charged, against the poles of another, making opposite poles meet. Then draw a piece of soft iron, placed at right angles upon the magnet to be charged, from the poles to the bend. Do this a number of times on each side of the magnet. If the magnet is of good steel, this produces a maximum power. It is the method of Jacobi, and is considered one of the best.

3297. Case-Hardening is the operation of giving a surface of steel to pieces of iron, by which they are rendered capable of receiving great external hardness, while the interior portion retains all the toughness of good wrought-iron. This is accomplished by heating the iron in contact with animal carbon, in close vessels. George Ede says:—The articles intended to be case-hardened are put into the box with animal carbon, and the box made air-tight by luting it with clay. They are then placed in the fire and kept at a light red heat for any length of time, according to the depth required. In half an hour after the box and its contents have been heated quite through, the hardness will scarcely be the thickness of a half dime; in an hour, double; and so forth, till the desired depth is acquired. The box is then taken from the fire, and the contents emptied into pure cold water. They can then be taken out of the water and dried (to keep them from rusting), by riddling them in a sieve with some dry saw-dust; and they are then ready for polishing. Case-hardening is a superficial conversion of iron into steel. It is not always merely for economy that iron is case-hardened, but for a multitude of things it is preferable to steel, and answers the purpose better. Delicate articles, to keep from blistering while heating, may be dipped into a powder of burnt leather, or bones, or other coaly animal matter.

3298. To Case-Harden with Charcoal. The goods, finished in every respect but polishing, are put into an iron box, and covered with animal or vegetable charcoal, and cemented at a red heat, for a period varying with the size and description of the articles operated on.

3299. Moxon's Method of Case-Hardening. Cow's horn or hoof is to be baked or thoroughly dried, and pulverized, in order that more may be got into the box with the articles. Or bones reduced to dust answer the same purpose. To this add an equal quantity of bay salt; mix them with stale chamber-lye, or white wine vinegar; cover the iron with this mixture, and bed it in the same in loam, or enclose it in an iron box; lay it on the hearth of the forge to dry and harden; then put it into the fire, and blow till the lump has a blood-red heat, and no higher, lest the mixture be burnt too much. Take the iron out, and immerse it in water.

3300. To Case-Harden. Make a paste with a concentrated solution of prussiate of potash and loam, and coat the iron therewith; then expose it to a strong red heat, and when it has fallen to a dull red, plunge the whole into cold water.

3301. To Case-Harden Polished Iron. The iron, previously polished and finished, is to be heated to a bright red and rubbed or sprinkled over with prussiate of potash. As soon as the prussiate appears to be decomposed and dissipated, plunge the article into cold water. When the process of case-hardening has been well conducted, the surface of the metal proves sufficiently hard to resist a file. The last two plans are a great improvement upon the common method. By the application of the prussiate, as in the last receipt, any part of a piece of iron may be case-hardened, without interfering with the rest.

3302. Improved Process of Hardening Steel. Articles manufactured of steel for the purposes of cutting, are, almost without an exception, taken from the forger to the hardener without undergoing any intermediate process; and such is the accustomed routine, that the mischief arising has escaped observation. The act of forging produces a strong scale or coating, which is spread over the whole of the blade; this scale or coating is unequal in substance, varying in proportion to the degree of heat communicated to the steel in forging; it is almost impenetrable to the action of water when immersed for the purpose of hardening. Hence it is that different degrees of hardness prevail in nearly every razor manufactured; this is evidently a positive defect; and so long as it continues to exist, great difference of temper must exist likewise. Instead, therefere, of hardening the blade from the anvil, let it be passed immediately from the hands of the forger to the grinder; a slight application of the stone will remove the whole of the scale or coating, and the razor will then be properly prepared to undergo the operation of hardening with advantage. It is plain that steel in this state heats in the fire with greater regularity, and that, when immersed, becomes equally hard from one extremity to the other. To this may be added, that, as the lowest possible heat at which steel becomes hard is indubitably the best, the mode here recommended will be found the only one by which the process of hardening can be effected with a less portion of fire than is, or can be, required in any other way. These observations are decisive, and will, in all probability, tend to establish in general use what cannot but be regarded as a very important improvement in the manufacturing of edge steel instruments.

3303. To Case-Harden Small Articles of Iron. Fuse together, in an iron vessel or crucible, 1 part prussiate of potash and 10 parts common salt, and allow the article to remain in the liquid 30 minutes, then put them in cold water and they will be case-hardened.

3304. To Clean a Shot Gun. Wrap clean tow around the cleaning rod; then take a bucket of tepid water—soap-suds if procurable—and run the rod up and down the barrel briskly until the water is quite black. Change the water until it runs quite clear through the nipple; pour clean tepid water down the barrel, and rub dry with fresh clean tow; run a little sweet oil on tow down the barrel for use. To clean the stock, rub it with linseed oil. If boiling hot water is used the barrel will dry sooner, and no fear need be apprehended of its injuring the temper of a fine gun. Some sportsmen use boiling vinegar, but we cannot recommend this method. The reason hot water does not injure the gun, is that boiling water is only 212° Fahr., and the gun was heated to 450° to give it its proper temper.

3305. Grease for Anointing Gun-Barrels on the Sea-Shore. It is said that an ointment made of corrosive sublimate and lard will prove an effectual protection against the rusting of gun-barrels on the sea-shore.

3306. To Protect Polished Steel from Rust. Nothing is equal to pure paraffine for preserving the polished surface of iron and steel from oxidation. The paraffine should be warmed, rubbed on, and then wiped off with a woolen rag. It will not change the color, whether bright or blue, and will protect the surface better than any varnish.

3307. To Protect Polished Metal from Rust. Take 10 pounds gutta-percha, 20 pounds mutton suet, 30 pounds beef suet, 2 gallons neats' foot oil, and 1 gallon rape oil. Melt together until thoroughly dissolved and mixed, and color with a small portion of rose pink; oil of thyme or other perfuming matter may be added. When cold the composition is to be rubbed on the surface of bright steel, iron, brass, or other metal, requiring protection from rust.

3308. To Remove Rust from Steel. Rust may be removed from steel by immersing the article in kerosene oil for a few days. The rust will become so much loosened that it may easily be rubbed off. By this simple method badly rusted knives and forks may be made to present a tolerable appearance, but for new goods there is no way to remove rust from metal but by getting below it, or renewing the surface. Where it is not deep-seated, emery paper will do, but if long standing the goods must be refinished.

3309. New Mode of Removing Rust. Plunge the article in a bath of 1 pint hydrochloric (muriatic) acid diluted with 1 quart water. Leave it there 24 hours; then take it out and rub well with a scrubbing-brush. The oxide will come off like dirt under the action of soap. Should any still remain, as is likely, in the corroded parts, return the metal to the bath for a few hours more, and repeat the scrubbing. The metal will present the appearance of dull lead. It must then be well washed in plain water several times, and thoroughly dried before a fire. Lastly, a little rubbing with oil and fine emery powder will restore the polish. Should oil or grease have mingled with the rust, it will be necessary to remove it by a hot solution of soda before submitting the metal to the acid. This last attacks the rust alone, without injuring the steel; but the washing in plain water is all-important, as, after the process, the metal will absorb oxygen from the atmosphere freely if any trace of the acid be allowed to remain.

Zinc. Zinc is a blueish white metal, having a specific gravity of 6.8 to 7.2; tough when cold, ductile and malleable at from 250° to 300° Fahr., brittle and easily pulverized at 500°; fuses at 773°, and sublimes unchanged at a white heat, in close vessels. It is scarcely affected by exposure to air and moisture; hence its general use in the arts for the manufacture of vessels of capacity, tubing, &c., that require lightness and durability. Acids, even diluted, attack zinc rapidly. It is also soluble in caustic alkalies. Heated to whiteness, 941° Fahr., in contact with the air, it burns with great brilliancy, and is converted into oxide, (flowers of zinc). It is very soluble in dilute sulphuric and muriatic acid, with the evolution of hydrogen gas. The salts of zinc are colorless.

Commercial zinc is never pure, and is obtained from the native sulphuret (zinc blende) or carbonate (calamine), by roasting those ores, and distilling them along with carbonaceous matter in a covered earthen crucible, having its bottom connected with an iron tube which terminates over a vessel of water situated beneath the furnace. The first portion that passes over contains cadmium and arsenic, and is indicated by what is technically called the *brown blaze;* but when the metallic vapor begins to burn with a blueish white flame, or the *blue blaze* commences, the volatilized metal is collected. Zinc may be alloyed with most of the metals. (*Cooley.*)

3311. Purification of Zinc. Granulate zinc by melting, and pouring it, while very hot, into a deep vessel filled with water. Place the granulated zinc in a Hessian crucible, in alternate layers, with one-fourth its weight of nitre, with an excess of nitre at the top. Cover the crucible, and secure the lid; then apply heat. When deflagration takes place, remove from the fire, separate the dross, and run the zinc into an ingot mould. It is quite free from arsenic.

3312. To Granulate Zinc. Granulated zinc is obtained by pouring the molten metal into a warm mortar and triturating vigorously, with an iron pestle, until it solidifies. (*See No.* 3311.)

3313. To Color Metals. Make a solution of 4 ounces hyposulphite of soda in 1½ pints of water, and add a solution of 1 ounce acetate of lead in the same quantity of water. Articles to be colored are placed in the mixture, which is then gradually heated to a boiling point. The effect of this solution is to give iron the effect of blue steel, zinc becomes bronze, and copper or brass becomes successively yellowish red, scarlet, deep blue, blueish white, and finally white with a tinge of rose. This solution has no effect on lead or tin. By replacing the acetate of lead in the solution with sulphate of copper, brass becomes of a fine rosy tint, then green, and finally, of an iridescent brown color. Zinc does not color in this solution, it throws down a precipitate of brown sulphuret of copper; but if boiled in a solution containing both lead and copper, it becomes covered with a black crust, which may be improved by a thin coating of wax. (*See No.* 3188.)

Tin. This metal approaches silver in whiteness and lustre. When pure, it is very malleable; is harder than lead; melts at 442° Fahr., and volatilizes at a white heat. Its specific gravity is 7.29 to 7.31. This metal is decomposed by nitric, sulphuric, and muriatic acids; and may be combined and alloyed with most of the useful metals. Tin occurs in nature in the state of the oxide, and sometimes as sulphuret (tin pyrites.) In Cornwall, England, it is found under the name of tin-stone, associated with copper ore, in the slate or granite rocks; and as an alluvial deposit (stream tin) in the beds of rivers. A pure article of tin comes from Banca. The metal is obtained from the ore, first reduced to powder in stamping mills, washed to remove earthy matter, and then roasted to expel arsenic and sulphur; it is then deoxidized or reduced by smelting with about $\frac{1}{6}$ its weight of powdered *culm* (a kind of coal found in Wales), and a little slacked lime; it is next refined by liquation (*see No.* 21), followed by a second smelting of the purer portion; it is then, while in a state of fusion, stirred with billets of green wood, allowed to settle, and cast into moulds. The product is termed refined or *block-tin.* Tin produces a peculiar crackling noise when bent; in this manner pure tin foil may be distinguished from the so-called tin foil in general use, which consists of lead with a tin surface only.

3315. Tests for the Purity of Tin. It is almost entirely dissolved by hydrochloric acid, yielding a colorless solution of muriate (chloride) of tin. If it contains arsenic, brownish-black flocks will be separated during the solution, and arseniuretted hydrogen evolved. The presence of other metals in tin may be detected by treating the muriate of tin solution with nitric acid, specific gravity 1.16, first in the cold, and afterwards with heat, until all the tin is precipitated in an insoluble peroxide; the decanted acid solution from pure tin leaves no residuum on evaporation. If there be a residuum, and dilution with water occasions a heavy white precipitate, the tin contained *bismuth.* If, after dilution, the addition of a solution of sulphate of ammonia or of soda produces a white precipitate, the tin contained *lead.* If red prussiate of potash gives a blue precipitate, it contained *iron;* and if the clear liquid leaves a residuum on evaporation, it contained *copper.*

3316. Grain Tin. This is made from block tin. The blocks are heated until they become brittle, and then allowed to fall from a considerable height, by which they are broken into small fragments, which constitute grain tin, or *tin in tears.*

3317. Tin Powder or Filings. Melt grain tin (*see No.* 3316) in an iron vessel, pour it in an earthen-ware mortar heated a little above its melting point, and triturate briskly as the metal cools; lastly, sift the product, and repeat the process with what remains in the sieve. Powdered tin is also prepared by filing and rasping.

3318. Powdered Tin. Take Cornish grain tin; melt it, and pour it into a wooden box, well rubbed on the inside with whiting or chalk; close the cover, and continue shaking it violently until the tin is reduced to powder; then wash it in clean water, and dry it immediately.

3319. To Make Feathered Tin. The object of feathering is to bring the tin into a state of minute subdivision, which permits it to be much more rapidly dissolved in acids. Procure an iron ladle having a capacity of about 12 fluid ounces, and a wooden or stoneware vessel containing 2 or 3 gallons of cold water. About 1 pound of pure bar tin, free from lead, is to be cut into pieces of about 2 inches in length, and melted in the ladle. When melted, pour the tin in a very small stream, from a height of about 3 feet, into the cold water. The ladle should be moved around in a small circle, when pouring, for if the whole of the melted tin strikes the water at one point, it will cool in lumps, and require remelting. The feathered tin is to be preserved in wooden boxes, the bottoms of which are perforated with small holes; or, what is better, kept in unglazed stoneware flower-pots. Solutions of tin containing iron or copper, or their salts, are unfit for dyeing bright reds. (*See Nos.* 107, *&c.*)

3320. Moire Metallique, or Crystallized Tin. A method of ornamenting the surface of tin plate by acids. The plates are washed with an alkaline solution, then in water, heated, and sponged or sprinkled with the acid solution. The appearance varies with the degree of heat and the nature and strength of the acids employed. The plates, after the application of the acids, are plunged into water, slightly acidulated, dried, and covered with white or colored varnishes. The following are some of the acid mixtures used: nitro-muriatic acid, in different degrees of dilution; sulphuric acid, with 5 parts of water, 1 part of sulphuric acid, 2 of muriatic acid, and 8 of water; a strong solution of nitric acid; 1 part nitric acid, 2 sulphuric, and 18 of water. A solution of potash is also used.

3321. Frosted Tin. A frosted appearance may be given to sheet tin by a wash of bichloride of tin.

3322. To Make a Tin Tree. Dissolve 3 drachms muriate (chloride) of tin in 1 pint distilled water, adding 10 or 15 drops nitric acid; and suspend a small rod of clean zinc in a phial containing the above solution.

Nickel. A white, hard, malleable, magnetic metal, capable of receiving the lustre of silver. Its specific gravity, when hammered, is about 8.82. Nickel is very infusible. Muriatic and sulphuric acid act on it with difficulty unless mixed with nitric acid, but it is freely soluble in the latter. Nickel does not oxidize or tarnish at the ordinary temperature. It alloys well with copper, tin, zinc, etc. It is obtained as follows: Roast the powdered ore first by itself and then with charcoal powder, till all the arsenic is expelled, and a garlic odor ceases to be evolved; mix the residuum with 3 parts sulphur and 1 part potash; melt in a crucible with a gentle heat, cool, edulcorate with water, dissolve in sulphuric acid mixed with a little nitric acid, precipitate with carbonate of potash, wash, dry, mix the precipitate with powdered charcoal, and reduce it by heat. For chemical purposes pure nickel is best obtained by moderately heating its oxalate in a covered crucible, lined with charcoal. The salts of nickel in the anhydrous state are for the most part yellow; when hydrated, green, and furnishing pale green solutions. Nickel is found present in meteoric iron, and is strongly magnetic, but loses this property when heated to 350° Fahr. It is chiefly employed in the manufacture of German silver. Sulphate of nickel is used medicinally, with soothing and soporific effects.

Mercury or Quicksilver.

This is a heavy liquid metal, possessing a nearly silver-white color, and a brilliant metallic lustre. The principal sources of this metal at the present time are the mines of Idria in Carniola, and Almaden in Spain, where it exists under the form of cinnabar, from which the pure metal is obtained by distilling that ore with lime or iron filings in iron retorts, by which the sulphur it contains is seized and retained, while the mercury rises in the state of vapor, and is condensed in suitable receivers. Its specific gravity, when pure, is 13.5; it solidifies at —39° (39° below zero) Fahr., and when solid is ductile, malleable, and tenacious; boils at 662° Fahr., but volatilizes slowly at the ordinary temperature of the atmosphere, and when mixed with water at from 140° to 160°, it is volatilized in considerable quantities. It unites with oxygen, forming two oxides; and with chlorine, forming calomel and corrosive sublimate; with the metals it forms amalgams, combining, however, with difficulty with iron, nickel, platinum, and some other less important metals. Its oxides form salts with the acids. The only acids that act on metallic mercury are the sulphuric and nitric; but for this purpose the former must be heated.

3325. Test for the Purity of Mercury. Metallic mercury may be known by its volatility; and when in a finely divided or pulverulent state, by the microscope, or by staining a piece of copper white when rubbed on it, or when heated beneath it. It is totally dissipated by heat, and dissolved by diluted nitric acid, but is insoluble in boiling muriatic acid. The acid poured off, and allowed to cool, is neither colored, nor yields a precipitate with sulphuretted hydrogen. A globule moved about on a sheet of paper yields no trail; pure sulphuric acid agitated with it (in the cold) evaporates when heated, without leaving any residuum.

3326. To Purify Mercury. Mercury, as imported, is usually very pure. It may be prepared for medical purposes by putting 6 parts into a retort and distilling off 4 parts. The whole of the mercury may, however, be safely drawn over. The product is to be agitated and boiled with 2 fluid drachms hydrochloric acid and 1 fluid ounce water for each pound of the metal; then washed with pure water, and dried by heat. A strong earthenware or iron retort, with a low neck or tube dipping into a basin of water, may be used for this purpose.

3327. To Purify Mercury. One of the quickest and best means of purifying mercury is to agitate it with a concentrated solution of nitrate of mercury, at a heat of 104° Fahr., then wash it with distilled water, and dry by passing several times through clean, dry chamois leather.

3328. To Purify Mercury. Distill equal parts of mercury and iron filings in an iron retort, into a vessel containing water.

3329. To Purify Mercury. The following simple method of purifying quicksilver is by Dr. Miller: Put the quicksilver into a bottle capable of containing 4 times its quantity, add a little powdered loaf sugar, and stopper the bottle; shake it vigorously for a few minutes, then open the bottle and blow fresh air into it with a pair of bellows. Repeat this 3 or 4 times, and filter the mixture through a cone of smooth writing paper having its apex pierced with a fine pin. The sugar is left behind in the filter with the oxides of any other metals present, and a small quantity of mercury in a state of minute division.

Aluminum.

This is the metallic base of alumina, which is the plastic principle of certain kinds of clay. The color of aluminum is white, inclining to blue; it is very malleable, and ductile. Its specific gravity is only about 2.60; its melting point not less than 1000° Fahr. It is the most sonorous of all metals. It is thus obtained:—Make a thick paste of alumina, powdered charcoal, sugar, and oil, and heat it in a covered crucible until all the organic matter is destroyed; then transfer the product to a porcelain tube, and connect the one end with another tube containing dried chloride of calcium, and the other end with a small tubulated receiver. Then expose the porcelain tube to the heat of a small oblong furnace, and, having connected the chloride of calcium tube with a vessel disengaging chlorine, pass the gas through the apparatus, at the same time raising the heat of the tube to redness. In 1 or 2 hours, or as soon as the tube becomes choked, the whole must be allowed to cool, and taken to pieces, and the sesquichloride of aluminum thus formed collected. Then place 9 or 10 pieces of potassium, of about the size of peas, in a platina crucible, and upon them an equal number of similar pieces of the sesquichloride of alumina, formed as above; the cover is now to be put on and secured in its place with a wire, and the heat of a spirit lamp cautiously applied, until the spontaneous incandescence of the matter ceases. When cold, throw the crucible into a large vessel of cold water, agitate and collect the gray powder deposited, and again wash it well and dry it. This gray powder consists of small metallic scales, resembling platina. It is not acted on by cold water, but is dissolved by the alkalies and some of the acids. Heated to redness, it catches fire and burns with great rapidity in the air, and in oxygen gas, with intense brilliancy. The powder, blown upon the flame of a candle, displays an immense number of inflamed points of great splendor.

3331. To Polish Aluminum. The substances generally employed for polishing aluminum are of no utility. Mouray recommends the use of an emulsion of equal parts of rum and olive oil, made by shaking these liquids together in a bottle. When the burnishing stone is used, the peculiar black streaks first appearing should not cause vexation, since they do not injure the metal in the least, and may be removed with a woolen rag. The objects in question may also be brightened in potash lye, in which case, however, care must be taken not to make use of too strong a lye. For cleaning purposes, benzole has been found best. Objects of aluminum can be electroplated without the least difficulty, and Mouray succeeded in imparting to them a bright, white lustre in passing them successively through a weak bath of hydrofluoric acid and aqua fortis. The effect thus obtained is said to be really surprising.

3332. To Frost Aluminum. The metal is plunged into a solution of caustic potash. The surface, becoming frosted, does not tarnish on exposure to the air.

Platinum—also called platina—is the heaviest substance but one (*see No.* 47) known, having a specific gravity of fully 21, which may be raised to about 21.5 by hammering. It is whiter than iron, harder than silver, infusible in the hottest furnace, and melts only before the compound blowpipe at a heat of about 3080° Fahr. On this account it is valuable for making capsules &c., intended to resist strong heat. Platinum undergoes no change by exposure to air and moisture, or the strongest heat of a smith's forge, and is not attacked by any of the pure acids, but is dissolved by chlorine and nitro-muriatic acid (aqua regia), though with more difficulty than gold. Spongy and powdered platinum possess the remarkable property of causing the union of oxygen and hydrogen gases. It is chiefly imported from South America, but is also found in the Ural Mountains of Russia, in Ceylon, and a few other places. Platinum, when alloyed with silver, is soluble in nitric acid; the pure metal is dissolved by aqua regia, and is more or less attacked by caustic alkali, nitre, phosphorus, &c., with heat. Platinum is precipitated from its solutions by deoxidizing substances under the form of a black powder, which has the power of absorbing oxygen, and again imparting it to combustible substances, and thus causing their oxidation. In this way alcohol and pyroxilic spirit may be converted into acetic and formic acids, &c. (*See No.* 1741, *also Acetic Acid.*) (*Cooley.*)

3334. To Purify Platinum. The native alloy (crude platinum) is acted upon, as far as possible, with nitro-muriatic acid, containing an excess of muriatic acid, and slightly diluted with water. The solution is precipitated by the addition of sal-ammoniac, which throws down nearly the whole of the platinum in the state of an *ammonio-chloride,* which is washed with a little cold water, dried, and heated to redness; the product is spongy metallic platinum. This is made into a thin uniform paste with water, pressed in a brass mould, to squeeze out the water and render the mass sufficiently solid to bear handling. It is then dried, carefully heated to whiteness, and hammered or pressed in the heated state; after this treatment it may be rolled into plates or worked into any desired shape. (*Cooley*).

3335. Platinated Asbestos. Dip asbestos in a solution of chloride of platinum, and heat it to redness. It causes the inflammation of hydrogen in the same manner as sponge platinum.

3336. Spongy Platinum. Dissolve separately crude bichloride of platinum, and hydrochlorate of ammonia in proof spirit; add the one solution to the other as long as a precipitate falls; this is collected, and, while still moist, formed into little balls or pieces, which are then dried, and gradually heated to redness.

3337. Spongy Platinum. Dissolve platinum, by the aid of heat, in a mixture of three parts nitric and 5 parts muriatic acid, avoiding great excess of acid. To this solution add a strong solution of muriate of ammonia; collect the resulting precipitate on a filter, and, when nearly dry, form it into a mass of the shape desired for the sponge. Heat this to whiteness on charcoal, with a blow-pipe or otherwise, and the platinum remains in the spongy state. Its characteristic properties may be restored, when lost, by simply heating it to redness.

3338. Platinum-Black. Platina Mohr. This is platinum in a finely divided state, and is obtained thus:—Add to a solution of bichloride of platinum, an excess of carbonate of soda, and a quantity of sugar. Boil until the precipitate which forms becomes, after a little while, perfectly black, and the supernatant liquid colorless; filter the powder, wash, and dry it by a gentle heat. Another method is by melting platina ore with twice its weight of zinc, powdering, digesting first in dilute sulphuric acid, and next in dilute nitric acid, to remove the zinc, assisting the action of the menstruum by heat; it is then digested in potash lye, and lastly in pure water, after which it is carefully dried. Platinum-black possesses the property of condensing gases, more especially oxygen, into its pores, and afterwards yielding it to various oxidizable substances. If some of it be mixed with alcohol into a paste, and spread on a watch glass, pure acetic acid is given off, and affords a ready means of diffusing the odor of vinegar in an apartment. (*See No.* 1741.)

Antimony. This is a bluish-white, lustrous, semi-crystalline, extremely brittle metal, of about 6.7 specific gravity; imparts brittleness to alloys; inflammable at high temperature; melts just under redness, 810° Fahr., fumes, boils, and volatilizes at a white heat, and when suddenly exposed to the air, inflames and is converted into teroxide of antimony, which is deposited in beautiful crystals. Antimony dissolves in hot hydrochloric acid, forming terchloride of antimony; nitric acid converts it into antimonic acid. This metal is obtained principally from France and Germany. Gold, when exposed to the vapors of antimony, loses its ductility and malleability, and becomes as brittle as antimony itself.

3340. Tests for Antimony. An acid solution of antimony gives, in combination with sulphuretted hydrogen, an orange-red precipitate, sparingly soluble in ammonia, but readily soluble in pure potassa and alkaline sulphurets. Hydrosulphuret of ammonia throws down from the acid solution an orange-red precipitate, readily soluble in excess of the precipitant, if the latter contain sulphur in excess; and the liquor containing the re-dissolved precipitate gives a yellow or orange-yellow precipitate on the addition of an acid. Ammonia, and potassa, and their carbonates (excepting in solutions of tartar emetic) give a bulky white precipitate; that from ammonia being insoluble in excess of the precipitant; that from potassa readily so; while those from the carbonate are only soluble on the application of heat.

3341. To Estimate the Purity of Antimony. Treat pulverized antimony with nitric acid; this oxidizes the antimony, and leaves it in an insoluble state, whilst it dissolves the other metals. Collect the oxide on a filter, wash, dry, ignite, and weigh it. This weight, multiplied by .843, gives the weight of pure metal in the sample examined. If this has been previously weighed, the percentage of pure metal is easily arrived at.

3342. To Obtain Metallic Antimony. Mix together 16 parts sulphuret of antimony and 6 parts cream of tartar, both in powder; put the mixture, in small quantities at a time, into a vessel heated to redness; when reaction ceases, fuse the mass, and, after 15 minutes, pour it out and separate the metal from the slag. The product is nearly pure.

Or: Equal parts of protoxide of antimony and bitartrate of potassa (cream of tartar); mix and fuse as above, and pour the metal into small conical moulds.

Or: 8 parts sulphuret of antimony, 6 parts cream of tartar, and 3 parts nitre. Treated as above.

Or: 2 parts sulphuret of antimony and 1 part iron filings; calcine at a strong heat in a covered crucible.

3343. To Obtain Commercial Antimony. Fuse together 100 parts sulphuret of antimony, 40 parts metallic iron, and 10 parts dry crude sulphate of soda. This produces from 60 to 65 parts of antimony, besides the scoriæ or ash, which is also valuable.

Bismuth. This metal is principally prepared in Germany, and, as imported, generally contains both arsenic and copper. It is a crystalline metal, very brittle, of a reddish white color; melts at about 500° Fahr., volatilizes at a strong heat, and the fumes form crystalline scales (flowers of bismuth). It burns when strongly heated in the air, and has a specific gravity of about 9.8. The addition of bismuth to other metals lowers their melting point in an extraordinary manner, making it a useful ingredient in the composition of type-metal and solders. (*See No.* 3499, *etc.*)

3345. To Purify Bismuth. Dissolve crude bismuth in nitric acid, and concentrate the solution by evaporation. Then pour the clear solution into a large bulk of distilled water, and a white powder (sub-nitrate of bismuth) will be precipitated. Collect the precipitate and digest it for a time in a little caustic potash, to dissolve away any arsenious acids that may be present; next wash and dry the sub-nitrate; heat it with about $\frac{1}{10}$ its weight of charcoal in an earthen crucible, and the pure bismuth will be found at the bottom of the crucible. (*Makins.*)

3346. To Separate Bismuth from Lead. Dissolve the mixed metal in nitric acid; add caustic potash in excess, and the oxides of bismuth and lead will be precipitated, but the lead oxide will be at once re-dissolved by the alkali. The oxide of bismuth can then be separated by filtration, washed, and ignited. (*Makins.*)

Alloys. Combinations of the metals with each other obtained by fusion. When mercury is one of the component metals, the compound is termed an amalgam. (*See No.* 3532.) Most of the metals unite with each other by fusion or amalgamation, and acquire new properties. Thus: copper alloyed with zinc, becomes brass, and possesses a different density, hardness, and color to either of its constituents. No general rules for the manufacture of alloys applicable to each can be given; but it may be remarked that, in uniting metals differing greatly in their melting points, the least fusible should be melted first, and the others added, one at a time, in their order of fusibility, the most fusible metal being the last to be added; also that, before the addition of each succeeding metal, the temperature of the already fused mass should be reduced to the lowest point at which it will remain fluid, or as near as possible to the fusing point of the metal to be next introduced, so that it may not evaporate or be oxidized, and thus cause the compound to be imperfect. This is a general rule, to be applied in most cases; but there are exceptions. For instance: gold will easily dissolve in melted tin; and platinum in many metals. If platinum were first melted, and zinc, for instance, added, the temperature necessary to obtain the fusion of platinum would be sufficient to volatilize the zinc. The mixture is usually effected under a flux, or some material that will prevent evaporation and exposure to the atmosphere. Thus: in melting lead and tin together, in forming solder, resin or tallow is thrown upon the surface; in tinning copper, the surface is rubbed with sal-ammoniac; and in combining some metals, powdered charcoal is used for the same purpose. (*See No.* 3470.) As we have already said, most of the alloys are prepared by simply fusing the metals together; but if there be a considerable difference in their specific gravities, the heavier very generally subsides, and the lower part of the mass thus differs in composition from the upper. This may be in a great measure prevented by agitating the alloy till it solidifies, but this is not always convenient. Thus, in stereotype plates, which are cast vertically, the upper side usually contains more antimony than the other. As a general rule, the substances (elements) of nature unite together in fixed and definite atomic proportions, thereby forming new compounds. Metals unite with non-metallic bodies, and obey the same general law; but metals, when united with metals, appear to form an exception, though much doubt exists on the subject. They seem to mix in any proportion, and are thereby modified, possessing thereafter properties which fit them for many purposes in commerce and art. These compounds, being considered at present non-chemical bodies, are classed together under the French term of alloys. Alloys are generally more fusible than the least fusible of the component metals; but are often harder and more brittle than the hardest and most brittle of the component metals. With some exceptions, the ductility and tenacity of an alloy is less than that of its metals.

3348. Table of the Principal Alloys of Copper. This table of the alloys of copper is from Dr. Ure. The bronze for statues is the composition used by Keller Brothers, the celebrated brass founders.

	Copper.	Zinc.	Tin.	Nickel.	Antimony	Lead.
Antique bronze sword	87.000		13.000			
" springs	97.000		3.000			
Bronze for statues	91.400	5.530	1.700			1.370
" for medals	90.000		10.000			
" for cannon	90.000		10.000			
" for cymbals	78.000		22.000			
" for gilding	82.257	17.481	0.238			0.024
" "	80.000	16.500	2.500			1.000
Speculum metal	66.000		34.000			
Brass for sheet	84.700	15.300				
Gilding metal	73.730	26.270				
Prince's metal	75.000	25.000				
" "	50.000	50.000				
Dutch metal	84.700	15.300				
English wire	70.290	29.260	0.170			0.280
Mosaic gold	66.000	34.000				
Gun metal for bearings, stocks, &c	90.300	9.670	0.030			
Muntz's metal	60.000	40.000				
Good yellow brass	66.000	34.000				
Babbitt's metal for bushing	8.300		83.400		8.300	
Bell metal for large bells	80.000		20.000			
Britannia metal	1.000	2.000	81.000		16.000	
Nickel silver, English	60.000	17.800		22.200		
" " Parisian	50.000	13.600		19.300		
German silver	50.000	25.000		25.000		
Pinchbeck	80.200	20.000				

3349. Properties of Metals. The metals form part of the elements of nature, are undecompounded bodies, and distinguished from the other elements by their lustre, weight, &c.

3350. Table Showing, in their Order, the Comparative Properties of Metals.

Order of Malleability.	Order of Ductility.	Order of Brittleness.
Gold,	Gold,	Antimony,
Silver,	Silver,	Arsenic,
Copper,	Platinum,	Bismuth,
Tin,	Iron,	Chromium,
Cadmium,	Copper,	Cobalt,
Platinum,	Zinc,	Manganese,
Lead,	Tin,	Molybdenum,
Zinc,	Lead,	Tellurium,
Iron,	Nickel,	Titanium.
Nickel,	Palladium,	Tungsten,
Palladium,	Cadmium,	Uranium,
Potassium,		Rhodium.

Order of Tenacity.		Order of Heat Conducting Power.	Order of Electrical Conducting Power.
Iron,	1,000	Gold,	Copper,
Copper,	550	Platinum,	Gold,
Platinum,	494	Silver,	Silver,
Silver,	349	Copper,	Zinc,
Gold,	273	Iron,	Platinum,
Zinc,	199	Zinc,	Iron,
Tin,	63	Tin,	Tin,
Lead,	50	Lead,	Lead,
			Mercury,
			Potassium.

3351. Lustre is so characteristic as to have formed the common expression "metallic lustre."

3352. Weight is also a rough distinguishing characteristic.

3353. Fusibility is a property common to all metals. Before some metals are rendered fluid by heat, they become pasty; such is an indication of malleability. The following table gives the degrees (Fahr.) of heat at which metals fuse:

Tin	442°
Bismuth	497°
Lead	612°
Zinc	773°
Antimony	810°
Silver	1,873°
Copper	1,996°
Gold	2,016°
Iron (Cast)	2,786°
Nickel	2,800° (about)
Manganese	3,000° (about)

3354. Malleability, or the property of being beaten out into thin plates without cracking or breaking, is common to several metals.

3355. Ductility is also a property found in some metals. It is allied to malleability, and often confounded with it. It is the property of being drawn into wire.

3356. Tenacity, or the resistance of being pulled asunder by the force of tension, varies exceedingly in metals.

3357. Brittleness, resulting from hardness, is a property also met with; and where the brittleness is not extreme, hardness is in favor where subjected to compression.

3358. How to Make Brass. This useful alloy of copper and zinc is now generally made by plunging the copper in slips into the zinc melted in the usual manner. The former metal rapidly combines with the fluid mass, and the addition is continued until an alloy is formed somewhat difficult of fusion, when the remainder of the copper is at once added. The brass thus formed is broken into pieces and remelted under charcoal, and a proper addition of either zinc or copper made to bring it up to the color and quality desired. Small quantities of brass may be made by melting the copper and zinc separately, pouring them together and stirring vigorously. (*See Copper Flux, No.* 3470.) It is then poured into moulds of granite. Before being submitted to the rolling press for reduction to thin plates, it has to undergo the operation of annealing. In the receipts which follow, it will be seen that the larger the proportion of copper, the darker the color, the greater the density, and, to a certain extent, the toughness, of the alloy. Zinc lessens the weight and color. Tin gives it hardness and grain, and lead toughens it and renders it fitter for working. An application of these principles will serve as a guide for the metals and proportions to be used to produce a brass of any description required.

3359. Fine Light Yellow Brass. Melt together 2 parts copper and 1 part zinc.

3360. Bright Yellow Malleable Brass. Melt together 7 parts copper and 3 parts zinc.

3361. Deep Yellow Malleable Brass. Melt together 4 parts copper and 1 part zinc.

3362. Brass Malleable whilst Hot. Melt together 3 parts copper and 2 parts zinc.

3363. Red Brass. Melt together 5 parts copper and 1 part zinc. As much as 10 parts of copper to 1 part zinc may be used, the color being a deeper red for every additional part of copper employed.

3364. Brass for Buttons. Copper, 8 parts, and zinc 5 parts. This is the Birmingham *platin.*

3365. Pale Brass for Buttons, &c. Melt together 16 parts fine light yellow brass (*see No.* 3359), 2 parts zinc, and 1 part tin.

3366. Common Pale Brass. Melt together 25 parts copper, 20 parts zinc, 3 parts lead, and 2 parts tin.

3367. Fine Pale Brass for Castings. Melt together 15 parts copper, 9 parts zinc, and 4 parts tin. This is rather brittle.

3368. Dark Brass for Castings. Melt together 90 parts copper, 7 parts zinc, 2 parts tin, and 1 part lead. The color will be still deeper by using 2 parts less of zinc, and 1 part more each of copper and tin.

3369. Pale Brass for Gilding. Melt together copper, 64 parts; 32 parts zinc, 3 parts lead, and 1 part tin.

3370. Red Brass for Gilding. Melt together 82 parts copper, 18 parts zinc, 3 parts tin, and 1 part lead.

3371. Brass for Solder. Melt together 12 parts fine yellow brass (*see No.* 3359), 6 parts zinc, and 1 part tin. Used for ordinary brazing.

3372. Pale Brass for Turning. Melt together 98 parts fine brass (*see No.* 3359), and 2 parts lead.

3373. Red Brass for Turning. Melt together 65 parts copper, 33 parts zinc, 2 parts lead.

3374. Red Brass for Wire. Melt together 72 parts copper and 28 parts zinc, properly annealed.

3375. Pale Brass for Wire. Melt together 64 parts copper, 34 parts zinc, and 2 parts lead.

3376. To Make Brass which Expands by Heat Equally with Iron. It is difficult to make a permanent joint between brass and iron, on account of their unequal expansion by heat. In a recent issue of the journal of "Applied Chemistry," a new alloy is given, for which the inventor claims an expansion by heat so nearly similar to that of iron, as to allow of a union between them, which, for all practical purposes, is permanent. This consists of a mixture of 79 parts copper, 15 parts zinc, and 6 parts tin.

3377. To Harden Brass. Brass is tempered or hardened by rolling or hammering; consequently, if any object is to be made of tempered brass, the hardening must be done before working it into the required shape.

3378. To Soften Brass. Heat it to a cherry red, and plunge it into water.

3379. To Cover Brass with Beautiful Lustre Colors. Dissolve 1 ounce cream of tartar in 1 quart boiling water; then add ½ ounce protochloride of tin dissolved in 4 ounces cold water. Next heat the whole to boiling, and decant the clear solution from a trifling precipitate, and pour, under continual stirring, into a solution of 3 ounces hyposulphate of soda in ½ pint water, then heat again to boiling, and filter from the separated sulphur. This solution produces on brass the various lustre colors, depending on the length of time during which the articles are allowed to remain in it. The colors at first will be light to dark gold yellow, passing through all the tints of red to an iridescent brown. A similar series of colors is produced by sulphide of copper and lead, which, however, are not remarkable for their stability; whether this defect will be obviated by the use of the tin solution, experience and time alone can show.

3380. To Put a Black Finish on Brass Instruments. Make a strong solution of nitrate of silver in one dish, and of nitrate of copper in another. Mix the two together, and plunge the brass in it. Now heat the brass evenly till the required degree of dead blackness is obtained. This is the method of producing the beautiful dead black so much admired in optical instruments, and which was so long kept a secret by the French.

3381. To Frost Watch Movements. Mix together 1 ounce each muriatic acid, nitric acid, and common salt; immerse the article, as far as it is to be frosted, in the mixture for a short time; then immerse it, so as just to cover it, in sour beer, and scour it under the beer with a brush made of fine brass wire (a scratch brush); wash it in water, and afterwards in alcohol. The surface is then ready to gild or silver-plate if desired.

3382. To Color Brass. Although no alloy presents a more agreeable appearance to the eye than brass when it is in a high state of polish, yet the facility with which it tarnishes has rendered it necessary to color or bronze it, especially in those instances where its use exposes it to the liability of being frequently handled. The following receipts are from a reliable German source, and are said to possess a high degree of permanence. (*See Nos.* 3771, *&c.*)

3383. To Give Brass an Orange Tint. An orange tint, inclining to gold, is produced by first polishing the brass and then plunging it for a few seconds into a neutral solution of crystallized acetate of copper, care being taken that the solution is completely destitute of all free acid, and possesses a warm temperature.

3384. To Color Brass Grey-Green. Dipped into a bath of copper, the brass being first polished, as in last receipt, the resulting tint is a grayish green.

3385. To Color Brass Violet. A beautiful violet is obtained by immersing the polished brass for a single instant in a solution of chloride of antimony, and rubbing it with a stick covered with cotton. The temperature of the brass at the time the operation is in progress has a great influence upon the beauty and delicacy of the tint; in this instance it should be heated to a degree so as just to be tolerable to the touch.

3386. To Give Brass a Moiré Appearance. A moiré appearance, vastly superior to that usually seen, is produced by boiling the object in a solution of sulphate of copper. According to the proportions observed between the zinc and the copper in the composition of the brass, so will the tints obtained vary. In many instances it requires the employment of a slight degree of friction, with a resinous or waxy varnish, to bring out the wavy appearance characteristic of moiré, which is also singularly enhanced by dropping a few iron nails into the bath.

3387. Black Lacquer for Brass. There are two methods of procuring a black lacquer upon the surface of brass. The one usually employed for optical and scientific instruments consists in first polishing the object with Tripoli, then washing it with a mixture composed of 1 part nitrate of tin and 2 parts chloride of gold, and, after allowing this wash to remain for nearly a quarter of an hour, wiping it off with a linen cloth. An excess of acid increases the intensity of the tint.

By another method copper turnings are dissolved in nitric acid until the acid is saturated; the objects are cleaned, immersed in the solution, and subsequently heated moderately over a charcoal fire. This process must be repeated in order to produce a black color, as the first trial only gives a deep green, and the finishing touch is to polish with olive oil.

3388. To Give Brass an English Look. Much pains are taken to give brass objects an English look. For this purpose they are first heated to redness, and then dipped in a weak solution of sulphuric acid. Afterwards they are immersed in dilute nitric acid, thoroughly washed in water, and dried in sawdust. To effect a uniformity in the color they are plunged into a bath consisting of 2 parts nitric acid and 1 part rain water, where they are suffered to remain for several minutes. Should the color not be free from spots and patches, the operation must be repeated until the desired effect is produced.

3389. To Clean Brass. Brass and copper are best cleaned with sweet oil and Tripoli, powdered bath-brick, rotten stone, or red brick-dust, rubbed on with flannel and polished with leather. Vitriol and muriatic acid make brass and copper very bright, but they very soon tarnish, and consequently require more frequent cleaning. A strong lye of roche-alum and water will also improve brass. A solution of oxalic acid rubbed over tarnished brass with a cotton rag, soon removes the tarnish, rendering the metal bright. The acid must be washed off with water, and the brass rubbed with whitening in powder and soft leather. When acids are employed for removing the oxide from brass, the metal must be thoroughly washed afterwards, or it will tarnish in a few minutes after being exposed to the air.

3390. To Give a Golden Color to Brass. A mixture of muriatic acid and alum dissolved in water imparts a golden color to brass articles that are steeped in it for a few seconds.

3391. Paste to Clean Brass. Soft soap, 2 ounces; rotten-stone, 4 ounces; beat them to a paste. Or: Rotten stone made into a paste with sweet oil. Or: Rotten-stone, 4 ounces; oxalic acid, 1 ounce; sweet oil, 1½ ounces; turpentine enough to make a paste. The first and last are best applied with a little water. The second, with a little spirits of turpentine, or sweet oil. Both require friction with soft leather.

3392. To Clean Brass Inlaid Work. Mix Tripoli and linseed oil, and dip into it a rubber made of a piece of an old hat, with which polish the work and rub off with clean soft leather. If the wood be ebony or rosewood, polish it with a little finely powdered elder ashes; or make a paste of rotten-stone, a little starch, sweet oil, and oxalic acid, mixed with water. The ornaments of a French clock are, however, best cleaned with bread-crumb, carefully rubbed, so as not to spoil the wood-work. Ormolu candlesticks, lamps, and branches, may be cleaned with soap and water. They will bear more cleaning than lacquered articles, which are spoiled by frequent rubbing, or by acids or strong alkalies.

3393. Solutions to Clean Brass. Finely powdered sal-ammoniac; water to moisten. Or: Roche alum, 1 part; water, 16 parts. Mix. The articles to be cleaned must be made warm, then rubbed with either of the above mixtures and finished with fine Tripoli. This process will give them the brilliancy of gold.

3394. Solution for Cleaning Brass Chains. Mix together 1 ounce sulphuric acid, ¾ ounce nitric acid, ½ drachm saltpetre, and 1 ounce rain water, and allow the solution to repose a few hours. Pass the article to be cleaned rapidly through the solution, and immediately wash it thoroughly with rain water. Dry in sawdust. This process will make old and discolored chains look as good as new.

3395. To Clean Very Dirty Brass. Rub some bichromate of potassa fine, pour over it about twice the bulk of sulphuric acid, and mix this with an equal quantity of water.

Wash immediately in plenty of water, wipe it, and rub perfectly dry, and polish with powdered rotten-stone. By this method the dirtiest brass may be made immediately bright.

3396. To Give Brass Ornaments a Fine Color. Brass ornaments, when not gilt or lacquered, may be cleansed, and a fine color given to them, by two simple processes. The first is to beat sal-ammoniac into a fine powder, then to moisten it with soft water, rubbing it on the ornaments, which must be afterwards rubbed dry with bran and whiting. The second is to wash the brass work with roche alum boiled to a strong lye, in the proportion of 1 ounce to 1 pint; when dry, it must be rubbed with fine Tripoli. Either of these processes will give to brass the brilliancy of gold.

3397. Counterfeit Gold. Fuse together 8 parts platinum, 5 parts pure copper, 2 parts pure zinc, 4 parts tin, and 3 parts pure lead, using saltpetre, sal-ammoniac, and powdered charcoal as fluxes. This compound metal strongly resembles gold in appearance, and resists many of the tests used for gold.

3398. Hard Gold. A mixture of 7 parts gold and 1 part copper appears to afford the maximum of hardness.

3399. Coin Gold. Melt together with saltpetre and sal-ammoniac, 22 grains pure gold with 2 grains of pure copper. The later American coin is alloyed with 2 grains of a mixture of 1 part silver and 2 parts copper. The copper used for alloying gold must be *pure*, otherwise the mixture will be brittle.

3400. To Make Eighteen Carat Gold. Pure gold, 18 parts, is alloyed with 4 parts pure copper and 2 parts silver. Or: 19½ parts coin gold, 3 parts copper, and 1½ parts silver.

3401. To Make Sixteen Carat Gold. Sixteen parts pure gold are mixed with 5½ parts copper, and 2½ parts silver. Or: 17 parts coin gold, 5 parts copper, and 2 parts silver.

3402. To Make Twelve Carat Gold. Coin gold, 75 parts; further alloyed with 40 parts copper, and 22 parts silver, make a combination of good appearance, which stands acid tests well.

3403. To Make Four Carat Gold. A good useful metal for cheap rings, &c., which will not blacken the finger, is made by mixing 4 parts gold with 2 parts silver, and 18 parts copper.

3404. To Make Green Gold. Pure gold, 19 parts, and 5 parts pure silver, combine to form an alloy of a beautiful green shade, very effective for foliated designs in jewelry.

3405. Pivots for Artificial Teeth. An alloy of platinum and silver is used for this purpose.

3406. Chaudet's Springs for Artificial Teeth. Equal parts of copper, silver, and palladium.

3407. Hard Silver. An alloy of 5 parts silver and 1 part copper forms the hardest alloy of these metals.

3408. French Coin Silver. This consists of 9 parts silver and 1 part copper.

3409. German Silver. This is a well-known alloy, the finer varieties of which nearly equal silver in whiteness and susceptibility of receiving a high polish, while they surpass it in hardness and durability. The mixture of the metals is effected in the same way as is given for making alloys. (*See No.* 3347.) The receipts here given are from the highest authorities, or are the results of actual analysis of the finest commercial samples.

3410. German Silver for Rolling. Nickel and zinc, each 1 part; copper, 2 parts. Very fine. Or: nickel, 25 parts; zinc, 20 parts; copper, 60 parts. Used for rolling.

3411. German Silver for Castings. Nickel and zinc, each 20 parts; copper, 60 parts; lead, 3 parts. For castings. Or, to either of the above add 2 to 3 per cent. of white sheet iron.

3412. Genuine German Silver. Copper, 40½ parts; nickel, 31½ parts; zinc, 25½ parts; iron, 2½ parts. This resembles the genuine German silver made from the ore of Hildburghausen, as well as Pakfong, as analyzed by Dr. Fyfe, and is equal to the best Chinese sample.

3413. Pelouze's German Silver. Equal parts of copper and nickel. Said to be superior to any of the alloys containing zinc. 2 parts of copper to 1 part of nickel make the alloy more malleable, though not so white.

3414. Chinese White Copper. This consists of 30 parts copper, 36 parts nickel, and 34 parts zinc.

3415. Pakfong, or White Copper from China. This is composed of 41 parts copper, 32 parts nickel, 2½ parts iron, and 24½ parts zinc. The Chinese Pakfong is said to be prepared from native ore. It is silvery white, takes a high polish, very sonorous, malleable both cold and at a dull red heat, and may be rolled into leaves or drawn into wire.

3416. White Spoon Metal. This is the alloy sold as *German plate.* Melt together 55 parts copper, 24 parts nickel, 16 parts zinc, 3 parts tin, and 2 parts iron. This is a useful alloy.

3417. Britannia Metal. Plate brass, 4 ounces; tin, 4 ounces; when fused add 4 ounces each of bismuth and antimony. This composition is added at discretion to melted tin.

3418. To Clean Britannia Ware. Britannia ware should be first washed with a woolen cloth and sweet oil, then washed in water and suds, and rubbed with soft leather and whiting. Thus treated, it will retain its beauty to the last. Britannia ware may also be cleaned in the same way as copper, in No. 3252.

3419. Type Metal. Lead, 3 parts; antimony, 1 part; melted together. Small types are usually made of a harder composition than large ones. A good stereotype metal is said to be made of lead, 9 parts; antimony, 2 parts; bismuth, 1 part. This alloy expands as it cools, and consequently brings out a fine impression.

3420. Bismuth and Lead. Lead, 2 parts to bismuth, 1 part, gives an alloy which dilates powerfully at the time of cooling. This property makes it extremely suitable to all castings in which the greatest sharpness and finish are desirable.

3421. Tin and Zinc. Tin and zinc, of each 1 part, is almost as tenacious as brass, and melts at 900° Fahrenheit.

3422. Pewter. Tin, 100 parts; antimony, 8 parts; copper, 4 parts; and bismuth, 1 part, constitute the compound commonly called pewter.

3423. Alloys of Steel. Steel is successfully alloyed with other metals, improving its qualities for some purposes. $\frac{1}{500}$ part of silver adds immensely to the hardness of steel, and yet increases its tenacity. $\frac{1}{100}$ part of platinum, though not forming so hard an alloy as the silver and steel, gives a very great degree of toughness. Rhodium, palladium, iridium, and osmium make steel very hard, but their use, from their cost, is confined mainly to the experimental laboratory. Platinum, in its malleable state, may be cut with a knife; but with steel it forms an alloy not to be touched with a file.

3424. Iron, Copper, and Zinc. An alloy consisting of 10 parts cast iron, 10 copper, and 80 zinc, does not adhere to the mould in casting, and it is of a beautiful lustre when filed and polished. The least fusible metals are melted first, and the zinc last, in making it.

3425. Ormolu, or Mosaic Gold. Copper and zinc, equal parts; melt together at the lowest possible temperature at which copper will fuse, and stir so as to produce a perfect admixture of the metals; then add gradually, small portions of zinc at a time, until the alloy acquires the proper color, which is perfectly white, while in the melted state. It must then be at once cast into figured moulds. This alloy should contain from 52 to 55 per cent. of zinc.

3426. White Metal. Lead, 10 ounces; bismuth, 6 ounces; and antimony, 4 drachms; or, 2 pounds antimony, 8 ounces brass, and 10 ounces tin.

3427. French Alloy for Forks and Spoons. This is a beautiful white metal, very hard, and taking a fine polish. It is composed of 69.8 parts of copper, 19.8 parts nickel, 5.5 of zinc, and 4.7 of cadmium.

3428. French Silver. The new French silver is apparently an improvement on the old-fashioned German silver, and it is stated to be applicable to all the purposes to which ordinary commercial silver is applicable. It is composed of copper, 56 per cent., nickel, 40.64, tungsten, 2.0, aluminum, 0.56. It is a white, ductile, malleable, tenacious, sonorous alloy; its specific gravity is nine-tenths that of silver, its metallic lustre superior to that of silver, and its fusibility less, probably on account of the tungsten it contains.

3429. The Alloys of Aluminum. We have to distinguish between alloys in which the aluminum predominates and such ones in which the other metals outweigh the latter. Those impart to the aluminum new properties. Iron and copper do not act injuriously if the admixture is not considerable. In regard to toughness, the union of 7 per cent. of iron can scarcely be distinguished from pure aluminum. Both metals easily combine with each other. Commercial aluminum mostly contains iron; it remains ductile with as much as 10 per cent. of copper, and when containing only half as much, it may be worked still easier. If alloyed with small quantities of zinc, tin, gold, or silver, the metal is rendered hard and more brilliant, but remains ductile. Especially recommended is the alloy consisting of 97 per cent. of aluminum, and 3 per cent of zinc. The alloy with 7 per cent. of tin can be worked well, but does not take a very fine polish, and cannot be cast, since a more fusible alloy with a large proportion of tin is separated. Aluminum and lead do not unite. The composition with 3 per cent. of silver and 97 of aluminum possesses a beautiful color, and in equal parts they yield an alloy of the hardness of bronze. The union of 99 per cent. of aluminum and 1 of gold is, though hard, still ductile; its color is that of green gold. With 10 per cent. of gold, the composition is rendered crystalline. In combining aluminum with copper, the latter must be melted first, and the former added gradually in small portions at a time. A combination of 10 parts aluminum and 90 parts copper produces a fine aluminum bronze, which, however, is brittle after the first mixing; it increases in strength and tenacity only after successive fusions, but with the loss, each time, of a little aluminum. This bronze may be forged at a dull red heat without presenting flaws or cracks. Like copper, it is rendered more ductile by being heated and plunged into cold water.

3430. Copper and Aluminum for Journals. The most important alloy of aluminum is that composed of 90 per cent. of copper and 10 per cent. of aluminum. It possesses a pale gold color, a hardness surpassing that of bronze, is susceptible of taking a fine polish, and is easier forged than soft iron. This alloy has found a ready market, and, if less costly, would replace red and yellow brass. Its hardness and tenacity render it peculiarly adapted for the journals and bearings of machinery. Christofle, of Paris, who uses it for a journal for a polishing disk, found that it lasted six times longer than ordinary journals—that is, 18 months. There were 2200 revolutions made per minute. It is further stated, on good authority, that a journal of this new bronze, which was employed for the axle of a sewing machine, making 240 revolutions per minute, did excellent service for 1 year without indicating the least deficiency. Journals of ordinary bronze do not, as is well known, last over 5 months. When more than 10 per cent. of aluminum enters into the composition of the bronze, the alloy gradually becomes weaker and less malleable, and at length so brittle that it is easily pounded in a mortar.

3431. Oroide, or Artificial Gold. This material is manufactured largely in the United States into imitation jewelry and other articles, scarcely distinguishable from gold, except by the inferior gravity; and it is a matter of surprise to almost any one to learn that it does not contain a single grain of the precious metal. It is made by taking 100 parts of pure copper, 17 of pure tin, 6 of magnesia, 9 of tartar of commerce, 3.6 of sal-ammoniac, and 1.6 of unslacked lime. The copper is first melted, and the other substances (excepting the tin) added, a little at a time, and the whole well stirred for 30 minutes, so as to produce a perfect mixture, when the tin is thrown in and stirred round until melted. The crucible is then covered, and the fusion kept up for 25 minutes, and the scum taken off, when the substance is ready for use. It is malleable and ductile, and can be worked in any form, even into leaves like gold. The alloy may also be made by substituting granulated zinc for tin, but it will not retain its brilliancy so long as when tin is employed.

3432. Talmi Gold. A beautiful gold-colored alloy, sold under the above name, gives, on analysis: copper, 86.4; zinc, 12.2; tin, 1.1; iron, 0.3. The presence of the iron was probably accidental.

3433. Yellow Dipping Metal. Melt together 2 parts brass, 1 part copper, with a little old brass, and ¼ ounce tin to every pound of copper. This alloy is almost of the color, etc., of gold coin.

3434. Alloy of the Standard Measure used by Government. This is composed of copper, 576 parts; tin, 59; yellow brass (22 copper to 1 of zinc), 48 parts.

3435. Dentists' Tin Alloys for Moulds. The gold plates on which artificial teeth are fastened, are fashioned to fit exactly to the mouth by being hammered between a mould and die, cast from a plaster model of the mouth. The plaster model is obtained from a mould of wax, pressed while soft into the cavities of the mouth, and allowed to harden. Duplicate moulds and dies are necessary, at different stages of the hammering, in order to obtain a perfectly fitting plate. The necessary characteristics of the metals used for the moulds and dies are fusibility, hardness, or toughness, and, especially for the moulds, a freedom from shrinkage in cooling. The metal usually employed for the dies consists of 8 parts tin, 1 part lead, and 1 part bismuth. This compound is much harder than tin, melts at a lower heat, shrinks little, or practically none, in casting; is tough and strong. It melts at about 330° Fahr. Although generally a harder and less fusible metal is used for the first swaging, this alloy is particularly convenient for taking duplicate dies for finishing. Its tenacity adapts it for cases of partial sets representing the teeth. The mould or counter-die metal is made by adding to 1 part of this mixture 6 parts of lead. The result is harder than lead, and does not yield like it under the blow, presenting a resistance sufficient to drive the plate up well against the die. Its shrinkage is but slight; it melts at from 450° to 460°. It is designed for use when the dipping process is resorted to. This consists in pouring the melted metal into an appropriately shaped vessel or mould, and pressing the plaster model into the metal before the moment of congelation. If used at the point of congelation, the plaster cast may be employed without previous baking; otherwise it should be baked to expel its water of crystallization.

3436. Hard Tin Alloys for Dentists' Moulds. The following formula affords a highly useful alloy, where toughness as well as hardness is essential: tin, 16 parts; antimony, 1 part; zinc, 1 part. This alloy is much harder than the preceding die metal, and equals it in tenacity, being suited for any kind of die; it requires a higher temperature to melt it, but it melts sooner than tin, or than the mould-metal mentioned in the preceding receipt, from a matrix of which a die may be taken by it with safety. It affords, in sand, a perfect die, does not shrink, and, whether poured into a sand or metal mould, comes out with a smooth, bright face. It is the best combination of these three metals for the purpose. But when dies are made of it from sand moulds, and a more fusible metal is needed for taking counter-dies or moulds from them, it may be had by a combination of 5 parts lead, 2 bismuth, and 1 tin; or, 5 parts lead, 3 to 4 bismuth, and 1 tin afford a still more fusible compound, although harder.

3437. Copper Alloys for Dentists' Moulds. A very hard and most valuable alloy for general use may be had by a mixture of tin, 12 parts; antimony, 2 parts; copper, 1 part. It is not much inferior to zinc in hardness, casts without sensible shrinkage, and makes a perfect and very handsome die, bright and smooth. It is less fusible than the hard tin die metal in last receipt, but may be used for taking dies from the mould-metal mentioned in No. 3435; but, as it melts at nearly the same temperature, this requires care. It will be found of value in connection with lead moulds made by dipping. (*See No.* 3435.) It is rather brittle for dies for partial sets representing the teeth, as these are liable to break on removing from the matrix; but it is abundantly strong enough for swaging purposes. In combining these metals (which may be done in an ordinary charcoal furnace, as it is by no means necessary to raise the heat to the melting point of copper), place the copper in a crucible and bring it to a red heat, then pour in the tin and antimony, melted, and cover the whole with charcoal dust, to prevent oxidation. The copper will soon liquefy, or dissolve, as it were, combining perfectly with the other metals, without further elevation of temperature. To guard better against volatilization of antimony, which takes place at a high red heat, it is well enough to add to the copper but half the tin at first, and when these are combined, add the antimony, and then the remaining tin. This also enables one to conduct the second melting in a larger crucible, or, indeed, in an iron ladle. It is best to let the melted mass cool down some, before pouring it from the crucible, as, if poured out at too high a heat, the alloy oxidizes. A larger proportion of antimony and zinc increases the hardness of the metal, but with a tendency to imperfect castings. If tin be used in larger quantity, the alloy is, of course, softer, and it shrinks when cast. The relative proportion of zinc and antimony, in respect to each other, may be somewhat varied, without material modification of the qualities of the compound; but, for the best results, the sum of these two metals should hold to the quantity of tin employed the ratio of about 1 to 8. For fluidity, an excess of antimony over copper appears to be requisite. For non-shrinkage, the joint amount of antimony and copper should be to the quantity of tin as about 1 to 4; as, for example, 8 parts tin, 1 antimony, 1 copper; or, 10 tin, 1½ antimony, 1 copper; or, 12 tin, 2 antimony, 1 copper. For taking counter-dies or moulds from dies of the last named alloys, a suitable metal, fusible at about 380°

Fahr., is had by a mixture of 3 parts lead, 1 part bismuth, and not over $\frac{1}{100}$ part tin. It is wonderful how small a quantity of tin serves to improve the alloys of lead and bismuth, giving them a white, clear lustre, preventing oxidation, promoting fusibility—in short, producing almost a new metal.

3438. Cadmium Alloys for Dentists' Moulds. By the use of cadmium we may produce still harder alloys than any of the preceding, possessing in an equal degree every other desirable quality. Thus, 10 parts of tin, 1 part of antimony, 1 of copper, and 1 of cadmium, produce a compound which has about the hardness of zinc; it casts perfectly, and is nearly all that could be desired, except that, like the copper die metals, it is rather brittle for certain castings. (*See No.* 3437.) Substituted for copper in these connections, cadmium appears to confer greater hardness and toughness, and, up to a certain point, promotes fusibility. 9 parts of tin, 1 part of antimony, and 1 part cadmium, furnish a very hard and tough metal of a compact, homogeneous structure, which casts without shrinkage, forming a perfect die with a smooth, bright face. It melts at about the melting point of tin. In the employment of cadmium, care must be taken not to subject it to a heat high enough to volatilize it. To avoid this danger, it is best to unite the other metals first, and then add the cadmium at a heat barely sufficient to melt it. The great objection to this metal is its expensiveness.

3439. Alloy of Nickel and Copper. A mixture of 1 part nickel and 2 parts copper produces a grayish-white metal, tenacious, ductile, and moderately fusible.

3440. Alloys of Platinum and Copper. A compound of 1 part platinum and 4 parts copper is of a yellow-pink color, hard, ductile, and susceptible of a fine polish.

An alloy of 3 parts platinum and 2 parts copper is nearly white, very hard, and brittle.

3441. French Bell Metal. The metal used in France for hand-bells, clock bells &c., is made of 55 to 60 parts copper, 30 to 40 parts tin, and 10 to 15 parts zinc.

3442. Red Tombac. Put into a crucible 5½ pounds copper; when fused add ½ pound zinc; these metals will combine, forming an alloy of a reddish color, but possessing more lustre than copper, and also greater durability.

3443. White Tombac. When copper is combined with arsenic, by melting them together in a close crucible, and covering the surface with common salt, to prevent oxidation, a white brittle alloy is formed.

3444. Speculum Metal for Telescopes. Melt 7 pounds of copper, and when fused add 3 pounds zinc and 4 pounds tin. These metals will combine to form a beautiful alloy of great lustre, and of a light yellow color, fitted to be made into specula for telescopes. Mr. Mudge used only copper and grain tin, in the proportion of 2 pounds of the former to 14½ ounces of the latter.

3445. Babbitt's Anti-Attrition Metal. Melt 4 pounds copper, add by degrees 12 pounds best quality Banca tin, 8 pounds regulus of antimony, and 12 pounds more tin while the composition is in a melted state. After the copper is melted and 4 or 5 pounds of tin have been added, the heat should be reduced to a dull red, to prevent oxidation; then add the remainder of the metal as above. In melting the composition, it is better to keep a small quantity of powdered charcoal on the surface of the metal. The above composition is called hardening. For lining the boxes, take 1 pound of this hardening and melt it with 2 pounds of Banca tin, which produces the lining metal for use. Thus, the proportions for lining metal are 4 pounds copper, 8 pounds regulus of antimony, and 96 pounds Banca tin.

3446. Gongs and Cymbals. The secret method employed by the Chinese for working the hard brittle bronze used for making gongs and cymbals, seems to be solved by the fact that the bronze of which these instruments are made, consisting of copper alloyed with about 20 per cent. of tin, and almost as brittle as glass at ordinary temperatures, becomes as malleable as soft iron, if worked at a dull red heat. This discovery was recently made in Paris, by M.M. Julien and Champion, the result of experiments at the Paris Mint.

3447. Phosphorus Bronzes. A great advance has lately been made in the construction of bronzes, by the addition of a small percentage of phosphorus, although the precise function of this substance has not been hitherto well understood. According to Levi and Kunzel, however, one cause of the inferiority in bronze consists in the constant presence of traces of tin in the state of an oxide, which acts mechanically by separating the molecules of the alloy, thus interposing a substance which in itself has no tenacity. The addition of phosphorus reduces this oxide, and renders the alloy much more perfect, improving its color, its tenacity, and all its physical properties. The grain of its fracture resembles more that of steel, its elasticity is much augmented, and its resistance to pressure sometimes more than doubled. Its durability is greater, and, when melted, it is of greater fluidity, and fills the mould in its finest details.

3448. Fontainemoreau's Bronzes. There is a kind of bronze known as Fontainemoreau's bronze, in which zinc predominates. It is said to answer well for chill moulding, that is, for pouring in metal moulds, by which method it is rendered very homogeneous. The crystalline nature of the zinc is entirely changed by the addition of a small proportion of copper, iron, &c. The alloy is hard, close-grained, and resembles steel. Moreover, it is easier to file than either zinc or copper. The following table presents the proportions in use:

Zinc.	Copper.	Cast Iron.	Lead.
90	8	1	1
91	8	0	1
92	8	0	0
92	7	1	0
97	2½	½	0
97	3	0	0
99½	0	½	0
99	1	0	0

3449. Use of Petroleum in Turning Metals. A bronze composed of seven parts of copper, 4 of zinc, and 1 of tin, has been found to be so hard as to be difficult to work, and yet of considerable value in certain ways when worked. Various methods have been attempted, aiming at effecting a ready working of this alloy, and M. Bechstein has recently, by soaking the alloy in petroleum, attained this desirable end.

3450. To Clean Bronze. It was observed in Berlin that those parts of a bronze statue which were much handled by the public retained a good surface, and this led to the conclusion that fat had something to do with it. An experiment was therefore tried for some years with four bronzes. One, says our authority—Chambers' Journal—was coated every day with oil, and wiped with a cloth; another was washed every day with water; the third was similarly washed, but was oiled twice a year; and the fourth was left untouched. The first looked beautifully; the third, which had been oiled twice a year, was passable; the second looked dead; and the fourth was dull and black.

3451. Engestroom Tutania. Melt together 4 parts copper, 8 parts regulus of antimony, and 1 part bismuth. When added to 100 parts of tin, this compound will be ready for use.

3452. Tutenag. Melt together 8 parts of copper, 5 parts of zinc, and 3 parts of nickel.

3453. Kustitien's Metal for Tinning. To 1 pound of malleable iron, at a white heat, add 5 ounces regulus of antimony, and 24 pounds of the purest Molucca tin. This alloy polishes without the blue tint, and is free from lead or arsenic.

3454. Expansion Metal. Melt together 9 parts of lead, 2 parts of antimony, and 1 part bismuth.

3455. Fluid Alloy of Sodium and Potassium. If 4 parts sodium are mixed with 2½ potassium, the alloy will have exactly the appearance and consistency of mercury, remaining liquid at the ordinary temperature of the air.

3456. Fusible Alloys. Bismuth, 8 parts; lead, 5 parts; tin, 3 parts; melt together. Melts below 212° Fahr. Or: Bismuth, 2 parts; lead, 5 parts; tin, 3 parts. Melts in boiling water. Or: Lead, 3 parts; tin, 2 parts; bismuth, 5 parts; mix. Melts at 197° Fahr. The above are used to make toy-spoons, to surprise children by their melting in hot tea or coffee; and to form pencils for writing on asses' skin, or paper prepared by rubbing burnt hartshorn into it. The last may be employed as an anatomical injection, by adding (after removing it from the fire), 1 part quicksilver (warm). *Liquid* at 172°; *solid* at 140° Fahr.

3457. Wood's Patent Fusible Metal melts between 150° and 160° Fahr. It consists of 3 parts cadmium, 4 tin, 8 lead, and 15 bismuth. It has a brilliant metallic lustre, and does not tarnish readily.

3458. The Most Fusible Alloy. There is an alloy of bismuth, tin, and lead, which, from its very low melting point, is called *fusible metal.* (*See No.* 3457). Dr. Von Hauer has found, however, that the addition of cadmium to the alloys of the above mentioned metals reduces their melting point still lower. An alloy of 4 volumes cadmium, with 5 volumes each tin, lead, and bismuth, is quite liquid at 150° Fahr. In parts by weight, the above would be 224 parts cadmium, 517½ lead, 295 tin, and 1050 bismuth. (*See No.* 52). An alloy of 3 volumes of cadmium with 4 each of tin, lead, and bismuth, fuses at 153½° Fahr, and an alloy of 1 equivalent of cadmium with two equivalents each of these three other metals, at 155½°, which is also the fusing point of an alloy of 1 part each of all the four metals. Dr. von Hauer made these alloys by fusing their ingredients in a covered porcelain crucible at the lowest practicable temperature. They all become pasty at lower temperatures than those given above; the temperatures quoted are those at which the alloys are perfectly fluid. It should be added that, unfortunately, all these alloys very rapidly oxidize when placed in water.

3459. Table of Alloys of Tin and Lead and their Melting Heats.

Tin.	Lead.	Bismuth.	Fahr.
1	25	0	558°
1	10	0	541
1	5	0	511
1	3	0	482
1	2	0	441
1	1	0	370
1½	1	0	334
2	1	0	340
3	1	0	356
4	1	0	365
5	1	0	378
6	1	0	381
4	4	1	320
3	3	1	310
2	2	1	292
1	1	1	254
1	2	2	236
5	3	3	202
3	5	8	197

Fluxes. This term is applied to substances of easy fusibility, which are added to others more refractory, to promote their fusion. Various fluxes are given in other portions of this work (*see Soldering and Enamels*), but the principal fluxes are the following:

3461. Black Flux. Cream of tartar, 2 parts; nitre, 1 part; powder, mix, and deflagrate by small quantities at a time, in a red hot crucible. This is merely carbonate of potash, mixed with charcoal in a finely-divided state. It is used for smelting metallic ores, and exercises a reducing action, as well as promoting the fusion. (*See No.* 11.)

3462. White, or Cornish Refining Flux. Cream of tartar and nitre, equal parts; deflagrate as last.

3463. Morveau's Reducing Flux. Powdered glass (free from lead), 8 parts; calcined borax and charcoal, each 1 part; all in fine powder, and triturated together thoroughly. Used as *black flux.* (*See No.* 3461.)

3464. Flux for Reducing Lead Ore. Take 6 parts red argol, 4 parts nitre, 2 parts borax, and 1 part fluorspar; pulverize well and mix thoroughly.

3465. Cornish Reducing Flux. Crude tartar, 10 parts; nitre, 4 parts; borax, 3 parts. Mix as the last.

3466. Crude Flux. Same as *black flux*, (*see No.* 3461), omitting the deflagration. Used for reducing. (*See No.* 26.)

3467. Liebig's Flux. Carbonate of soda (dry, *see No.* 2065), and cyanide of potassium, 1 part each. Used for reducing arsenious acid.

3468. Fresenius' Flux. Carbonate of potassa (dry), (*see No.* 2065), 3 parts; cyanide of potassium, 1 part. For the arsenical compounds.

3469. Christison's Flux for Arsenic. Carbonate of soda, (crystallized), 8 parts; charcoal (in fine powder), 1 part; mixture is gradually to be heated to redness.

3470. Flux for Copper. Sal-enixum (the refuse from aquafortis), to be obtained at most of the chemical works at a trifling cost, is strongly recommended by Larkin as a general flux for copper foundings, particularly where large masses of copper have to be melted prior to adding the tin and zinc. Nothing is equal to it. This, with charcoal, surpasses everything else.

3471. Various Fluxes. Borax, tartar, nitre, sal-ammoniac, common salt, limestone, glass, fluorspar, resin, and several other substances are used as fluxes in fusing metals, and soldering. On the large scale crude tartar is employed. (*See No.* 3472.)

Soldering and Welding.

Soldering is the art of uniting the surfaces of metals by partial fusion, and the insertion of an alloy between the edges, which is called solder, it being more fusible than the metals which it unites. Solders are distinguished as hard and soft, according to their difficulty of fusion. Hard solders usually melt only at a red heat, but soft solders fuse at lower temperatures. In order to join metals, it is obvious that a solder must be used that melts at a lower temperature than the metals to be joined; but it may also be necessary that it approach as nearly as possible to them in point of hardness; and occasionally, as is especially the case with jewelry, similarity of color is an object. The heat requisite for soldering small articles, such as jewelry, etc., is usually obtained by employing a common blowpipe; as by its use a sudden heat may be concentrated on a small point. Where a larger surface has to be heated, the flame of a spirit lamp is used. For brazing, or uniting larger objects with hard solder, a furnace, or, if necessary, a forge, may be employed. In working tin plates, the solder is applied and fused by a heated copper tool called a soldering-iron. The surfaces of parts to be joined by soldering must be perfectly clean; and in order to ensure this, as well as to counteract the oxidization which most metals undergo when heated, a flux is used (*see No.* 3479), which neutralizes or removes these otherwise serious impediments, securing a firm joint.

3473. To Make Soldering Fluid for Soft Solder. Into muriatic acid put small pieces of zinc until all bubbling ceases; some add 1 ounce sal-ammoniac to each pound of the liquid.

3474. Neutral Soldering Fluid. Dissolve zinc in muriatic acid as above, then warm the solution and add sufficient oxide or carbonate of tin in powder to neutralize it. This prevents the fluid from corroding the seams.

3475. Soldering Liquid. Soldering liquid is made by taking hydrochloric acid, ¼ pint; granulated tin, 1½ ounce; dissolve and add some common solder and hydrochlorate of ammonia.

3476. Flux for Soldering. For common purposes powdered resin is generally used. Stearic acid, obtained from the candle factories, makes a good flux for fine tin work.

3477. Flux for Soldering Iron or Steel. Dissolve chloride of zinc in alcohol.

3478. Flux for Soldering Steel. This answers perfectly when the fracture is an old one. To a saturated solution of zinc in 1 pint muriatic acid, add 4 ounces pulverized sal-ammoniac; boil it for 10 minutes; put it, when cold, in a well corked bottle. The boiling must be done in a copper vessel.

3479. Soft Soldering. The solder is an alloy of 2 parts tin to 1 part lead, fusible at 340° Fahr.; or, for cheapness, the proportion is sometimes 3 to 2, fusible at 334°. This substance is applied with a hot copper tool called a soldering-iron, or by blowpipe flame. Heat, however, causes the edges of the metal to oxidize; therefore the edges are covered with a substance having a strong attraction for oxygen, and disposing the metal to unite to the solder at a low temperature. Such substances are called fluxes, and are chiefly borax, resin, sal-ammoniac, muriate of zinc, Venice turpentine, tallow, or oil.

3480. Flux for Soldering Brass. For brass or other similar alloy, resin, sal-ammoniac, and muriate of zinc are the proper fluxes. Should the work be heavy and thick, the soldering requires to be done over a charcoal fire in order to keep the tool heated within proper limits. It is as well to tin the surfaces before soldering; in some cases simply dipping into a pot of melted solder effects the purpose, but the dip must be done instantly to be effective.

3481. Flux for Soldering Zinc. Zinc is difficult to solder, from the fact that it is apt to withdraw the tin from the soldering bolt, zinc and copper having a stronger affinity for each other than tin and copper. The proper flux is muriate of zinc, made by dissolving small bits of zinc or zinc drops in muriatic acid mixed with an equal bulk of water.

3482. Flux for Soldering Tin and Lead. Tin and lead require resin or oil as the flux.

3483. Flux for Soldering Pewter. Pewter requires a flux of oil, and may, in addition to the soldering-iron process, be soldered by a current of heated air.

3484. Flux for Soldering Britannia Metal. Britannia metal should have muriate of zinc for a flux, and be soldered by the blowpipe.

3485. To Solder Iron. Iron requires the surfaces to be tinned over before being soldered; the method is given in No. 3515.

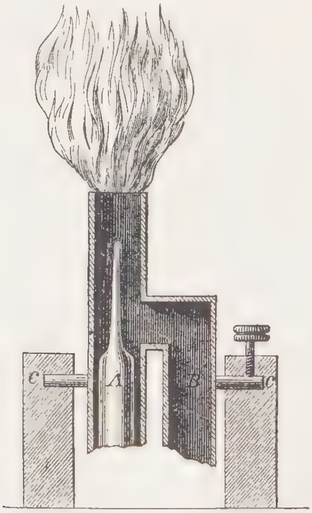
3486. To Soft Solder Small Articles. Join together the parts to be soldered, first moistening them with soldering fluid (*see No.* 3473), lay a small piece of solder over the joint and apply heat, either over a spirit flame, or by means of the blowpipe, as the case may be. The heat should be withdrawn at the moment of fusion, otherwise the solder may become brittle.

3487. To Soft Solder Smooth Surfaces. Where two smooth surfaces are to be joined, moisten the surfaces with soldering fluid (*see No.* 3473), and lay a piece of tin foil between them, press them together closely, and apply heat sufficient to fuse the tin foil.

3488. Hard Soldering or Brazing. The alloy used in hard soldering is generally made of equal parts of copper and zinc; much of the zinc, however, is lost in the process, so that the real proportion is not equal parts. The alloy is heated over a charcoal fire, and broken to granulations in an iron mortar. A different proportion is used for soldering copper and iron, viz.: 3 zinc to 1 copper. The commercial name is "spelter solder."

3489. Flux for Spelter Solder. The flux employed for spelter solder is borax, which can either be used separately, or mixed, by rubbing to a cream, or mixed with the solder in a very little water.

3490. To Hard Solder. When the work is cleaned, bound, fluxed, and speltered, the whole is subjected to a clear charcoal or coke fire; or, what is now becoming far more general, convenient, cleanly, and manageable, a bellows blowpipe. The air passes from a bellows propelled by the foot through *A* (*See Engraving.*) The gas passes through *B*, and the flame can be directed to any point, on account of its being hinged at *C C*. The flame can be extended by using several stands, or by constructing several burners on one stand. The heat is much greater than from charcoal, can be regulated at pleasure, and kept at the same temperature for any given time. In the process of hard soldering, the water should be driven off by gentle heat; the fusion of the flux soon follows; a glassy substance appears after the froth, which, in its turn, is replaced by the alloy in red liquid form; the blue flame from the ignited zinc informs the operator that the solder now fuses, so that, as soon as the work is flushed with solder, it must be withdrawn, allowed to set, and cooled in water.



3491. To Make Solder. The mixture of the metals is performed by melting them together in the same manner as for alloys (*see No.* 3347), with the aid of a flux. The metals employed should be pure, especially silver, as silver coin makes the solder too hard.

3492. Solder for Gold. Take 12 parts pure gold, 2 parts pure silver, and 2 parts copper.

3493. Solder for Silver. Take 5 parts pure silver—not silver coin—6 parts brass, and 2 parts zinc. Or, 2 parts silver, 1 part common pins. This is an easy flowing solder. Use a gas jet to solder with.

3494. Hard Solder. Take 2 parts copper and 1 part zinc. Or, equal parts of copper and zinc. (*See No.* 3488.)

3495. Solder for Silver. Take 19 parts fine silver, 1 part copper, and 10 parts brass.

3496. Silver Solder. Melt together 34 parts, by weight, silver coin, and 5 parts copper; after cooling a little, drop into the mixture 4 parts zinc, then heat again.

3497. Fine Silver Solder. Melt in a clean crucible, 19 parts pure silver, 10 parts brass, and 1 part copper; add a small piece of borax as a flux.

3498. Solder for Copper. Same as hard soldering. (*See No.* 3488.)

3499. Solder for Tin. Take 4 parts pewter, 1 part tin, and 1 part bismuth. Use powdered resin when soldering.

3500. Fine Soft Solder. Take 2 parts tin and 1 part lead. Used for soldering tin plates, and tinning copper. Add resin as a flux when melting.

3501. Very Soft Solder. Equal parts of tin, lead, and bismuth.

3502. Solder for Pewter. Take 2 parts tin, 1 part each of lead and bismuth.

3503. Glaziers' Solder. Take 3 parts lead and 1 part tin. This melts at 500° Fahr.

3504. Solder Fusible in Boiling Water. Take 1 part tin, 1 part lead, and 2 parts bismuth.

3505. Plumbers' Solder. Take 1 part bismuth, 5 parts lead, and 3 parts tin.

3506. Solder for Lead. Take 2 parts lead and 1 part tin. This is good, if, when a small quantity is poured on a table, little bright spots rise as it cools. When soldering with this, use powdered resin.

3507. Brass Solder. Take 12 parts brass, 6 parts zinc, and 1 part tin.

3508. Strong Brass Solder. Take 3 parts brass and 1 part zinc.

3509. To Solder Fine Brass Work. Wet the parts with a strong solution of sal-ammoniac, apply tin foil between them, and heat no more than is necessary to fuse the tin.

3510. To Solder Iron. Apply good tough brass (*see No.* 3358) with borax mixed with water to the consistence of cream. (*See No.* 3488.)

3511. Solder for Joining Steel. This is better than the usual brass solder, for uniting cast-steel, &c., as it fuses at a lower temperature; and, being whiter in appearance, renders the seams less observable. Take 19 parts, by weight, fine silver; 1 part copper, and 2 parts brass; melt them under a coat of charcoal dust.

3512. Brass Solder for Brazing Iron or Steel. Thin plates of brass are to be melted between the pieces that are to be joined. If the work be very fine—as when two leaves of a broken saw are to be brazed together—cover it with pulverized borax, dissolved in water, that it may incorporate with some brass powder which is added to it; the piece must be then exposed to the fire without touching the coals, and heated till the brass is seen to run.

3513. To Solder Ferrules for Tool Handles, &c. Take the ferrule, lap round the jointing a small piece of brass wire, then just wet the ferrule, scatter ground borax on the joining, put it on the end of a wire, and hold it in the fire till the brass fuses. It will fill up the joining, and form a perfect solder. It may afterwards be turned in the lathe.

3514. To Tin Iron for Soldering, &c. Drop zinc shavings into muriatic (hydrochloric) acid, until it will dissolve no more; then add $\frac{1}{4}$ its bulk of soft water. Iron, however rusty, will be cleansed by this solution, and receive from it a sufficient coating of zinc for solder to adhere to. (*See No.* 3642.)

3515. To Solder Grey Cast-Iron. First dip the castings in alcohol, after which, sprinkle muriate of ammonia (sal-ammoniac) over the surface to be soldered. Then hold the casting over a charcoal fire till the sal-ammoniac begins to smoke, then dip it into melted tin (not solder). This prepares the metal for soldering, which can then be done in the ordinary way.

3516. Solder for Iron. Fuse together 67 parts copper and 33 parts zinc. Or: 60 parts copper and 40 parts zinc.

3517. Hard Solder for Copper or Brass. Take 13 parts copper and 1 part zinc. Or: 7 copper, 3 zinc and 2 tin.

3518. Solder for Brass in General. Take 4 parts of scraps of the metal to be soldered, and 1 part zinc.

3519. To Make Solder-Drops. Melt the solder, and pour it in a steady stream of about $\frac{1}{8}$ inch in diameter, from a height of 2 or 3 inches, into cold water; taking care that the solder, at the time of pouring, is no hotter than is just necessary for fluidity.

3520. Aluminum Solder. Mouray employs five different solders, being different proportions of zinc, copper, and aluminum. The copper is melted first, the aluminum is then added in 3 or 4 portions; when the whole is melted, it is stirred with an iron rod. The crucible is then withdrawn from the fire, the zinc gradually stirred into the mass, and the whole poured into ingot shaped moulds, previously wiped out with benzine. The parts given in the following proportions are by weight.

1.—80 parts zinc, 8 parts copper, 12 parts aluminum.
2.—85 " " 6 " " 9 " "
3.—88 " " 5 " " 7 " "
4.—90 " " 4 " " 6 " "
5.—94 " " 2 " " 4 " "

3521. To Solder Aluminum. The selection of either of the above solders depends upon the nature of the object. In order to quicken its fusion on the metal, a mixture of 3 parts balsam of copaiba and 1 part Venice turpentine is made use of; otherwise the operation is performed in exactly the same manner as in the brazing of other metals. The aluminum solder is spread without delay on the previously heated surfaces to be fastened together. In heating, the blue gas flame or the turpentine blast lamp is employed. The more and oftener the solder is spread over the surface, the better it is.

3522. Aluminum Solder. If soft solder is fused with one-half, one-fourth, or one-eighth of its weight of zinc amalgam (to be made by dissolving zinc in mercury, *see No.* 3539), a more or less hard and easily-fusible solder is obtained, which may be used to solder aluminum to itself or to other metals.

3523. Welding Powder for Iron and Steel. For welding iron and steel a composition has lately been patented in Belgium, consisting of iron filings, 40 parts; borax, 20 parts; balsam of copaiba, or some other resinous oil, 2; and sal-ammoniac, 3 parts. They are mixed, heated, and pulverized. The process of welding is much the same as usual. The surfaces to be welded are powdered with the composition, and then brought to a cherry-red heat, at which the powder melts, when the portions to be united are taken from the fire and joined. If the pieces to be welded are too large to be both introduced at the same time into the forge, one can be first heated with the welding powder to a cherry-red heat, and the others afterwards to a white heat, after which the welding may be effected.

3524. Welding Composition for Cast Steel. Take borax, 10 parts; sal-ammoniac, 1 part; grind or pound them roughly together, then fuse them in a metal pot over a clear fire, taking care to continue the heat until all spume has disappeared from the surface. When the liquid appears clear, the composition is ready to be poured out to cool and concrete; afterwards, being ground to a fine powder, it is ready for use. To use this composition, the steel to be welded is first raised to a bright yellow heat, it is then dipped among the welding powder, and again placed in the fire, until it attains the same degree of heat as before; it is then ready to be placed under the hammer.

3525. Welding Powder. For iron or steel, or both together, calcine and pulverize together 100 parts iron or steel filings, 10 sal-ammoniac, 6 borax, 5 balsam copaiba. One of the pieces is to be heated red, carefully cleaned of scale, the composition is to be spread upon it, and the other piece applied at a white heat and welded with the hammer.

3526. Welding Composition. Fuse borax with $\frac{1}{16}$ its weight sal-ammoniac, cool, pulverize, and mix with an equal weight of quicklime, when it is to be sprinkled on the red hot iron and the latter replaced in the fire.

3527. Welding Composition. Take 15 parts borax, 2 of sal-ammoniac, and 2 of prussiate of potash. Being dissolved in water, the water should be gradually evaporated at a low temperature.

3528. Welding Composition. Mix 10 parts borax with 1 part sal-ammoniac; fuse the mixture, and pour it on an iron plate. When cold, pulverize it, and mix it with an equal weight of quicklime, sprinkle it on iron heated to redness, and replace it in the fire. It may be welded below the usual heat.

3529. Compound for Welding Steel. The following composition is said to be superior to borax for welding steel. Mix coarsely powdered borax with a thin paste of Prussian blue; then let it dry. The combination seems to be a rational one.

3530. Antimonoid. A welding powder, named antimonoid, has been in use for some time past in Germany, and found to be of great efficiency. The formula for its preparation has, until lately, been kept a secret; it consists of 4 parts iron turnings, 3 parts borax, 2 parts borate of iron, and 1 of water.

3531. Fluxes for Soldering and Welding.

For Iron or steel	Borax or sal-ammoniac.
" Tinned iron	Resin or chloride of zinc.
" Copper and brass	Sal-ammoniac or chloride of zinc.
" Zinc	Chloride of zinc.
" Lead	Tallow or resin.
" Lead and tin pipes	Resin and sweet oil.

Amalgams. Substances formed by mixing quicksilver with another metal. Alloys containing quicksilver. Mercury unites with most of the metals by mere contact, forming amalgams. These are employed for various purposes in the arts, as silvering, gilding, coating mirrors, &c.

3533. Amalgam of Gold for Gilding Brass, Copper, &c. Place one part grain or leaf gold in a small iron saucepan or ladle, perfectly clean, then add 8 parts mercury, and apply a gentle heat, when the gold will dissolve; agitate the mixture for one minute with a smooth iron stirrer, and pour it out on a clean plate or stone slab. When cold it is ready for use.

3534. To Gild with Gold Amalgam. For gilding brass, copper, &c. The metal to be gilded is first rubbed over with a solution of nitrate of mercury, and then covered with a very thin film of the amalgam. On heat being applied, the mercury volatilizes, leaving the gold behind. A much less proportion of gold is often employed than the above, where a very thin and cheap gilding is required, as, by increasing the quantity of the mercury, the precious metal may be extended over a much larger surface. (*See No.* 3394.)

3535. Amalgam of Silver for Silvering Metals. Prepare in the same way as amalgam of gold, but substitute silver instead of gold. (*See No.* 3533.)

3536. To Obtain Pure Silver in Powder. The best process to obtain pure silver in powder, is by adding copper to a dilute solution of silver in nitric acid, until all action ceases. The silver is precipitated in a fine powder. Before using the silver powder to prepare amalgam, it must be thoroughly washed until the water ceases to have any acid taste, or litmus paper is unchanged by it. (*See Nos.* 3212, *&c.*) The silver in this form, besides being necessarily purer, amalgamates more readily with the quicksilver.

3537. To Make a Solution of Silver. Dissolve a silver coin in *slightly* diluted nitric acid. Mexican coin is preferable, because it is purer. (*See No.* 3213.)

3538. Amalgam for Silvering the Insides of Convex Mirrors, Glass Globes, &c. Lead and tin, of each 2 ounces; bismuth, 2 ounces; mercury, 4 ounces. Add the mercury to the rest in a melted state and remove from the fire; mix well with an iron rod. This amalgam melts at a low heat, and is employed for silvering the insides of hollow glass vessels, globes, convex mirrors, &c. The glass, being well cleaned, is carefully warmed, and the amalgam, rendered fluid by heat, is then poured in, and the vessel turned round and round, so that the metal may be brought in contact with every part of the glass which it is desired to cover. At a certain temperature this amalgam readily adheres to glass. (*See Nos.* 3545, *and* 3614.)

3539. To Make Zinc Amalgam for Electrical Machines. Melt 2 ounces zinc in a ladle, remove from the fire, and stir into it 5 ounces mercury previously heated. Stir till cold, and then powder it. Keep it in a tightly corked bottle.

3540. Improved Electric Amalgam. It is well known that a deposit of moisture greatly interferes with the action of electrical machines, experiments often wholly failing from this cause, especially in the winter season. Mr. F. Dietlen, of Klagenfurt, has devised a method by which he obviates this difficulty, consisting simply in a modification of the amalgamation of the rubber cushion. For this purpose he pours petroleum over zinc filings, and adds an equal quantity of mercury (though an excess of mercury facilitates the process). The mixture is then brought, by working together in a mortar, to the condition of a homogeneous paste, and pressed between a double cloth. A soft mass is thus obtained, which, however, soon hardens; but which, being finely pulverized and mixed with a proper quantity of grease, is spread upon the rubber cushion. This makes the surface quite glossy, and, when the glass disk has previously been wiped with a piece of cotton slightly impregnated with petroleum or benzine, will develop electricity abundantly, even in damp localities where the usual arrangement fails.

3541. Boettger's Amalgam for Electrical Machines. Boettger recommends a mixture of 2 parts (by weight) of pure zinc, while melted, to be mixed with 1 part of mercury. This should be kept in pieces in a well-stoppered flask, and is said to be superior to the amalgam made of 2 parts mercury, 1 zinc, and 1 tin.

3542. Tin Amalgam. Amalgam of tin forms readily by introducing the solid metal into the mercury. In this way hexagonal crystalline formations have been observed; there is always a decided contraction in bulk. The hard amalgam of tin obtained by passing the liquid amalgam through fine leather, then drying, and afterwards rubbing under water, forms one of the plastic cements for filling teeth. (*See No.* 3553). It hardens within a few days, and is, besides, used for hermetically closing glass tubes. Mixed with a little silver amalgam it is a less plastic mass and requires a little more mercury, but it hardens much sooner.

3543. Copper Amalgam. Copper amalgam is best obtained by first precipitating metallic copper in a fine state of division from a solution of 3 ounces of blue vitriol in a quart of water mixed with an ounce of oil of vitriol, by means of clean wrought iron; then, after washing it thoroughly with hot water, moistening the powder with a solution of proto-nitrate of mercury, and finally incorporating it under water in a mortar with the required quantity of mercury. This amalgam, like the hard amalgam of tin, has the property of being softened and rendered plastic by mere trituration with a pestle. The proportions are generally 3 parts of copper to 7 of mercury.

3544. Tin and Cadmium Amalgam. Similar properties to tin and copper amalgams belong to the compound amalgam of tin and cadmium, which are fused together in the proportion of 2 to 1 and mixed with warmed mercury in excess, which latter is removed by pressure when cold. (*See No.* 3549.)

3545. Amalgam for Silvering Glass Ornaments. The silver coating of glass beads and those large sized glass ornaments now in fashion, is produced by shaking within them an amalgam composed of 8 parts bismuth, 5 of lead, 3 of tin, and from 7 to 9 parts of mercury. (*See No.* 3538.) A mixture of 2 parts each tin and bismuth and 1 of mercury, when powdered, is used for painting as imitation silver bronzes.

3546. Amalgams of the Alkaline Metals. The amalgams of the alkaline metals are remarkable for their hardness, though the metals sodium and potassium themselves are quite soft at the ordinary temperature. One per cent. of sodium in mercury produces an amalgam which is liquid, but still quite thick, and ½ per cent. of potassium renders the mercury still more so. A very hard compound is that consisting of 200 parts of mercury, 10 of potassium, and 1 of sodium. By means of the alkaline amalgams, most other mercurial alloys may be produced, by introducing them into the solution of other metals. Zinc amalgam is likewise used for the purpose.

3547. Amalgam of Fusible Metal. Fusible metal forms an amalgam with $\frac{1}{16}$ of its weight of mercury, which fuses far below the boiling point of water; cadmium increases the fusibility still more. A mixed amalgam for injecting anatomical preparations, which is hard at ordinary temperature, but becomes soft at 150°, and fuses at 176° Fahr., consists of 20 parts of bismuth, 12 of lead, 7 of tin, and 4 of mercury. (*See Nos.* 3456, *&c.*)

3548. Amalgam for Varnishing Plaster Casts. Melt together 1 part each tin and bismuth, and stir in thoroughly 1 part mercury. When cool, pound the amalgam with white of egg, forming a metallic paint which may be laid on with a brush.

3549. Evans' Tooth Amalgam. Take of pure grain tin, 2 parts; cadmium and bees' wax, of each 1 part; melt them together in a porcelain crucible at a heat not exceeding 600° Fahr., and cast the alloy so as to form a small ingot, which, when cold, must be reduced to filings. For use, a small quantity of these filings is formed into an amalgam with quicksilver, the excess of the latter is squeezed out through a piece of chamois leather, and the amalgam at once applied to the tooth. (*See No.* 3550.) This cement is recommended by Mr. Evans as very durable and unobjectionable. Its color is intermediate between that of silver and tin, but it is said not to darken so readily as the simple amalgams of those metals. (*See No.* 3544.)

3550. Dentists' Amalgam, or Gold Stopping. The dentists, in preparing and using this, commonly proceed as follows: A little pure grain-gold is heated in a bright iron ladle (or capsule), and enough pure mercury added to render it of a doughy consistence at the temperature of hot water. When it has become cold, the excess of mercury, if any, is removed by pressure in a piece of chamois leather. In using it, a little of the amalgam, as hot as can be borne, is kneaded in the hand, and at once pressed into the cavity of the tooth, where it gradually hardens. It is an excellent and durable stopping, and is, perhaps, preferable to all others, except the diamond tooth cement (*see Index*) for filling up cracks and cavities in the enamel, particularly of the front teeth, on account of its color and the ease of its application.

3551. Dentists' Amalgam of Silver is used in the same way as the last; but its color is less natural, and is apt to be blackened by the sulphur in the secretions of the mouth and the food. (*See No.* 3535.)

3552. Dentists' Amalgams of Tin and Zinc are also employed as tooth cement, but are inferior in color to, darken sooner, and possess less durability, than that of silver.

3553. Alloy for Filling Teeth. An alloy, which is sold in commerce in the shape of large, almost white filings, shows upon analysis the following composition: Tin, 611; silver, 388; copper, 1. The alloy is to be amalgamated before use by warming it in a spoon with a little mercury. The combination takes place rapidly, and the amalgam, while still warm, is pressed in a piece of soft leather, whereby the excess of mercury is removed. It is now far preferable to the celebrated copper amalgam, as it retains its white color in the mouth, while the other turns dark. The hardness is a little less than that of the copper amalgam. (*See No.* 3542.)

3554. To Recover the Silver Alloy from Dentists' Amalgam. The silver alloy may be easily obtained from scraps of dentists' amalgam in the following manner: Provide 2 crucibles of different sizes, so that the smaller one, inverted, will rest a little way within the larger. Make a hole, about ¼ inch in diameter, in the bottom of the smaller, to provide a vent for the mercurial vapors. Place the pieces of amalgam in the larger crucible, invert the smaller one into it, lute them, and fasten them firmly together with steel wire. Place the whole, as soon as the luting is dry, into a blast furnace, and in a short time the mercury will all have passed off in vapor, when the crucible may be set aside to cool, and the alloy will be found in a button at the bottom. As some portion of the tin in the alloy has been lost in the operation, the button should be remelted in a clean open crucible, with the addition of a little pure tin. This will now be ready to make again into amalgam as occasion requires.

3555. Ruhmkorf's Amalgamating Fluid. Dissolve by heat 2 parts by weight of mercury in 1 part aqua regia; when dissolved, add 10 parts hydrochloric acid. A worn-out zinc will be amalgamated in a few seconds by immersion in this fluid.

Gilding, Silvering, &c.

In this department we give processes for gilding and silvering wood, metals, paper, and glass; together with a number of receipts for coating various metals with other metallic deposits.

3557. Implements for Gilding on Wood. A sufficient quantity of leaf-gold, which is of two sorts—deep gold, and pale, or lemon gold. The former is the best; the latter very useful, and may occasionally be introduced for variety or effect.

A gilder's cushion; an oblong piece of wood, covered with rough calf-skin, stuffed with flannel several times doubled, with a border of parchment, about 4 inches deep at one end, to prevent the air blowing the leaves about when placed on the cushion.

A gilding knife, with a straight and very smooth edge, sharp enough to cut the gold, but not sufficiently so to cut the cushion. It must be *perfectly* clean, or the gold leaf will adhere to it.

Several camel's-hair pencils of assorted sizes; and tips, made of a few long camel's hairs put between two cards, in the same manner as hairs are put into tin cases for brushes, thus making a flat brush with a very few hairs.

A burnisher, which is a crooked piece of agate set in a long wooden handle.

3558. Burnished Gilding. This style of gilding is adapted for fine work, such as picture frames and other fancy furniture. We shall endeavor to give the necessary instructions, in the following receipts, to those who wish to undertake this kind of work, and with care and practice they may perform the operation successfully.

3559. To Make Size for Preparing Picture Frames and Other Wood Work for Gilding. To ½ pound parchment shavings, or cuttings of white leather, add 3 quarts water, and boil it in a proper vessel till reduced to nearly half the quantity; then take it off the fire, and strain it through a sieve. Be careful, in the boiling, to keep it well stirred, and do not let it burn.

3560. To Prepare or Whiten Picture Frames or Wood Work. First, with the above size alone, and boiling-hot, go over the frames in every part; then mix a sufficient quantity of whiting with size, to the consistency of thick cream, with which go over every part of the frame 6 or 7 times, carefully letting each coat dry before proceeding with the next; this will produce a white ground, nearly or quite $\frac{1}{16}$ inch in thickness. The size must not be too thick, and, when mixed with the whiting, should not be put on as hot as the first coat is by itself. It will be better to separate the dirty or coarse parts of the whiting by straining it through a sieve.

3561. To Clean and Polish Frames. When the prepared frames are quite dry, clean and polish them. To do this, wet a small piece at a time, and, with a smooth, fine piece of cloth, dipped in water, rub the part till all the inequalities are removed, and for those parts where the fingers will not enter, as the mouldings, &c., wind the wet cloth round a piece of wood, and by this means make the surface all equally smooth and even. Where there is carved work, &c., it will sometimes be necessary to bring the mouldings to their original sharpness by means of chisels, gouges, &c., as the preparation will be apt to fill up all the finer parts of the work, which must be thus restored. It is sometimes the practice, after polishing, to go over the work once with fine yellow or Roman ochre.

3562. To Make Gold Size for Frames. Grind fine sal-ammoniac well with a muller and stone; scrape into it a little beef-suet, and grind all well together; after which mix in with a pallet knife a small proportion of parchment size with a double proportion of water.

3563. Gold Size for Picture Frames. Grind a lump of tobacco pipe clay into a very stiff paste with thin size; add a small quantity of red ochre and fine black lead, ground very fine, and temper the whole with a small piece of tallow.

3564. To Prepare Picture Frames for Gilding. Take a small cup or pipkin, into which put as much gold size as you judge sufficient for the work in hand; add parchment size till it will just flow from the brush; when quite hot, pass over your work with a very soft brush, taking care not to put the first coat too thick; let it dry, and repeat it two or three times more, and, when quite dry, brush the whole with a stiff brush, to remove any roughness. The work is now ready for applying the gold. The parchment size should be of such a consistence, when cold, as the common jelly sold in the stores; for if too thick it will be apt to chip, and if too thin it will not have sufficient body.

3565. To Apply Gold Leaf to Picture Frames and Other Wood Work. This is the most difficult part of the operation, and requires some practice; but, with a little caution and attention, it may be easily performed. Turn the gold out of the book onto the cushion, a leaf at a time; then, passing the gilding-knife under a leaf, bring it into a convenient part of the cushion for cutting it into the size of the pieces required; breathe gently on the centre of the leaf, and it will lay flat on the cushion; then cut it to the proper size by sawing it gently with the knife till divided. Place the work in a position nearly horizontal, and, with a long-haired camel's-hair pencil dipped in water (or with a small quantity of brandy in the water), go over as much of it as the piece of gold is to cover; then take up the gold from the cushion with the tip; drawing it over the forehead or cheek will damp it sufficiently to adhere to the gold, which must then carefully be transferred to its place on the work, and, gently breathing on it, it will adhere; but take care that the part to which it is applied is sufficiently wet; indeed, it must be floating, or the gold will be apt to crack. Proceed in this manner by a little at a time, and do not attempt to cover too much at once. Be careful, in proceeding with the work, if any flaws or cracks appear, to take a corresponding piece of gold, and apply it immediately; sometimes, also, it will be necessary, when the gold does not appear to adhere sufficiently, to draw a pencil quite filled with water close to the edge of the gold, so that the water may run underneath it.

3566. To Burnish Gold. When the work is covered with gold, set it by to dry; it will be ready to burnish in about eight or ten hours; but this will depend on the warmth of the room or state of the air. When it is ready, those parts which are to be burnished must be dusted with a soft brush, and, wiping the burnisher with a piece of soft wash-leather (quite dry), begin to burnish about an inch or two in length at a time, taking care not to lean too hard, but with a gentle and quick motion apply the tool till it is equally bright all over.

3567. Matting, or Dead Gold. Those parts of the work which look dull from not being burnished, are now to be matted, that is, are to be made to look like dead gold; for if left in its natural state it will have a shining appearance, which must be thus rectified. Grind some vermilion, or yellow ochre, very fine, and mix a very small portion either with the parchment size or with the white of an egg, and with a very soft brush lay it even and smooth on the parts intended to look dull; if well done, it will add greatly to the beauty of the work. The work must be well cleared of superfluous gold, by means of a soft brush (a hat brush answers the purpose well), previous to burnishing or matting.

3568. To Finish Gilding. It is now only necessary to touch the parts in the hollows with a composition made by grinding vermilion, gamboge, and red lead, very fine, with oil of turpentine, and applying it carefully with a small brush in the parts required, and inserting suitable bits of gold leaf with a camel's-hair brush. Sometimes the finishing is done by means of shell-gold, which is the best method; it should be diluted with gum-arabic, and applied with a small brush.

3569. To Make Shell-Gold. Take any quantity of leaf-gold, and grind it, with a small portion of honey, to a fine powder; add a little gum-arabic and sugar candy, with a little water, and mix it well together; put it in a shell to dry until wanted.

3570. Oil Gilding is that which is designed for out-door work, to stand the weather and wash, and is performed with oil and varnish. Where the object is to give a high finish, paint the work with a color composed of the finest white lead and yellow ochre, in such proportions that the color shall be as near as possible to the color of the gold to be employed, mixed with oil (not boiled), and turpentine, till of the consistence of thin paint; this to be laid on evenly, and allowed to dry thoroughly, then repeat it for 5 or even more coats, till it is perceived that the grain or roughness of the object to be gilt is entirely hidden. When the last coat is dry it must be rubbed perfectly smooth, first with pumice stone, and finished with a piece of woolen cloth and finely pounded pumice; and lastly, with putty powder, till it is smooth as glass. It must then be varnished over with fine lac varnish several times, applying a slight degree of heat after each coat. This may be done by holding a hot iron near it till the varnish has flowed smooth and even over the surface. When the last coat of varnish is quite hard it must be polished; this is done by putting on a horse-hair glove, and rubbing the surface with this first, then with Tripoli, applied with a piece of wet woolen cloth; and lastly, by wet putty powder, first applied with woolen cloth, then with the bare hand, till it is as bright as glass. It must then be varnished over with a thin coat (the thinner the better) of gold size, and when sufficiently dry the gold is to be applied, beginning at the part that is dryest. When gilt, it is to be allowed to remain for two or three days, and then brushed over lightly with a camel's-hair brush to remove superfluous gold. It is next to be varnished with spirit varnish, applying heat as before, then varnished with copal varnish two or three times, allowing it to become perfectly hard between each coat; after the last coat of varnish it is finished by polishing, first with Tripoli, applied with a soft cloth and water, and then with the bare hand and a little oil, and wiped dry.

3571. Oil Size for Gilding. Grind calcined red ochre with the best and oldest drying oil, and mix with it a little oil of turpentine when used. When the work is to be gilded, first give it a coat of parchment size; then apply the above size where requisite, either in patterns or letters, and let it remain, till, by touching it with the finger, it feels just sticky; then apply the gold leaf, and dab it on with a piece of cotton; in about an hour wash off the superfluous gold with sponge and water, and when dry, varnish it with copal varnish.

3572. Water Size. Water size (for burnished gilding) is parchment size ground with yellow ochre.

3573. To Prevent the Adhesion of Gold Leaf. Painters and decorators will find the following plan a good one to simplify a most troublesome part of their work: A small piece of ball liquorice, dissolved in water, applied with a flat camel's-hair brush to the place intended to be left ungilt, will prevent the leaf adhering. The solution must be weak. Made thick and gummy, it is very useful to protect ornamental parts of work that is to be repainted.

3574. To Gild the Edges of Books and Paper. The gold applied to the edges of books, &c., is in the same state as for various ornamental purposes, namely, an extremely thin leaf. Before the case or cover of the book is quite finished, the volume is struck forcibly against the back, so as to make the fore-edge flat instead of concave. It is then placed in a press, with the exposed edge uppermost. The edge is scraped smooth with a piece of steel, and is coated with a mixture of red chalk and water. The gold is blown out from small books, and spread on a leather cushion, where it is cut to the proper size by a smooth-edged knife. A camel's-hair pencil is dipped into white of egg mixed with water, and with this the partially dry edge of the book is moistened; the gold is then taken up on a tip brush, and applied to the moistened edge, to which it instantly adheres. When all the three edges have been gilt in this way, and allowed to remain a very few minutes, take a burnisher formed of a very smooth piece of hard stone (usually bloodstone), and rub the gold very forcibly, which gives the gold a high degree of polish.

3575. Gilding on Glass. Mix powdered gold (*see No.* 2517) with thick gum-arabic and powdered borax. With this trace the design on the glass, and then bake it in a hot oven. Thus the gum is burnt, and the borax is vitrified, at the same time the gold is fixed on the glass.

Monograms and names may thus be gilded on glass or china.

3576. To Gild with Dutch Metal. The imitation of gold or silver leaf known as Dutch metal is much used for common purposes. The article to be gilded is prepared with a coating of oil size, on which the metal is laid. The sizing is not allowed to dry quite so long as for gold or silver leaf; the metal being laid on as soon as the size has set sufficiently not to smear. Metal is not handled with a gilding cushion and tip; but the books, with the metal in them, are cut into pieces of the requisite shape, with a pair of shears or scissors, and the metal leaf laid on the sizing direct from the portions of the book; after which it is pressed close by means of a roller covered with flannel, and finally brushed over the same as gold leaf, being careful to brush *with* and not *against* the overlap. White Dutch metal, nicely managed, and flowed over with shellac spirit varnish (colored with gamboge), makes a very good, cheap, and durable substitute for gold leaf.

3577. Grecian Gilding. Dissolve equal parts of sal-ammoniac and corrosive sublimate in nitric acid, and a solution of gold is to be made with the above mixture as a solvent; after slight concentration, the liquid is applied to the surface of silver, which immediately becomes black, but, on being heated, exhibits a rich gilded surface.

3578. Japanners' Gilding. The surface is covered with oil size thinned with spirits of turpentine, and gold in powder (*see No.* 2517) is gently dabbed on with a puff of wash-leather. This gives the appearance of frosted gold. A coating of varnish is next given, followed by a gentle heat in the stove.

3579. Leaf Gilding. This term is commonly applied to the gilding of paper, vellum, &c., by applying leaf gold to the surface previously prepared with a coating of gum water, size, or white of egg. It may be burnished with an agate.

3580. To Make Oil Gold Size. This is usually made from the sediment which collects at the bottom of the pot or dish in which painters wash their brushes, thoroughly ground and stained.

3581. Oil Gilding. The surface is prepared or primed with a coat of white lead in drying oil; then follow 2, 3, or 4 coats of calcined white lead ground in linseed oil and turpentine, with an interval of at least 24 hours between each coat, which must be carefully smoothed off with pumice-stone or shave grass. The gold size (*see No.* 3580) is next applied. When the gold size coat is sufficiently dry, the gold leaf is applied and pressed on with a wad or soft brush. After a few days for hardening, a coat of spirit varnish is applied, and the surface passed cautiously and evenly over a chafing dish of charcoal. For indoor work, it is finished off with a coat of pale oil varnish.

3582. To Gild Polished Metal. Polished silver, copper, brass, &c., may be gilded by the direct application of gold leaf to the surface heated to a bluish tint, pressing it on gently and carefully with the burnisher. This process is repeated until the proper thickness and tone is attained. Then it is polished with the burnisher and colored at the stove.

3583. Gold Tracing on Metal. Writing or any device in gold may be made on polished steel or iron, by tracing on the surface with a camel-hair pencil, using an ethereal solution of gold. The ether evaporating leaves a coating of gold, which may then be polished. (*See No.* 3585.)

3584. Water Gilding. This process involves several distinct operations, and can only be performed successfully by those who have learned the art practically.

3585. Ethereal Solution of Gold for Gilding on Steel. This process answers equally well for either gold or platina. Dissolve any quantity of gold or platina in nitro-muriatic acid (aqua regia), until no further effervescence is occasioned by the application of heat. (*See No.* 3588.) Evaporate the solution of gold or platina, thus formed, to dryness, in a gentle heat (it will then be freed from all excess of acid, which is essential), and redissolve the dry mass in as little water as possible; next take a separating funnel or pipette (*see No.* 0000), fill it about one-fourth with the liquid, and the other three parts must be filled with the very best sulphuric ether. If this be rightly managed, the two liquids will not mix. Then place the tube in a horizontal position, and gently turn it round with the finger and thumb. The ether will very soon be impregnated with the gold or platina, which may be known by its changing its color; replace it in a perpendicular position, and let it rest for 24 hours, having first stopped up the upper orifice with a cork. The liquid will then be divided into two parts—the darkest coloring being underneath. To separate them, take out the cork and let the dark liquid flow out; when it has disappeared, stop the tube immediately with the cork, and what remains in the tube is fit for use, and may be called gilding liquid. Let it be put into a bottle, and tightly corked. The muriate of gold or platina, formed by digesting these metals in nitro-muriatic acid, must be entirely free from all excess of acid, because it will otherwise act too forcibly on the steel, and cause the coating of gold to peel off. Pure gold must be employed; the ether must not be shaken with the muriate of gold, as is advised by some, for it will then be sure to contain acid; but if the two liquids be brought continually into contact by the motion described, the affinity between ether and gold is so strong as to overcome the obstacle of gravity, and it will hold the gold in solution. The ethereal solution may also be concentrated by gentle evaporation.

3586. To Gild Steel. Pour some of the ethereal solution of gold into a wine-glass, and dip into it the blade of a new penknife, lancet, or razor; withdraw the instrument, and allow the ether to evaporate; the blade will then be found covered with a beautiful coat of gold. The blade may be moistened with a clean rag, or a small piece of very dry sponge dipped into the ether, and the same effect will be produced. (*See No.* 3585.)

3587. Elkington's Patent, or Anglo-German Gilding. The articles, after being perfectly cleaned from scale or grease, and receiving a proper face, are to be suspended on wires, dipped into the gilding liquid (*see No.* 3588) boiling hot, and moved about therein, when, in from a few seconds to a minute, depending on the newness and strength of the liquid, the requisite coating of gold will be deposited on them. By a little practice the time to withdraw the articles is readily known; the duration of the immersion required to produce any given effect gradually increases as the liquid weakens by use. When properly gilded, the articles are withdrawn from the solution of gold, washed in clean water, and dried; after which they undergo the usual operation of coloring, &c. A dead appearance is produced by the application to the articles of a weak solution of nitrate of mercury previously to the immersion; or the deadening may be given by applying a solution of the nitrate to the gilded surface and then expelling the mercury by heat.

3588. Elkington's Patent Gilding Liquid. Fine gold, 5 ounces (troy); nitro-muriatic acid (aqua regia), 52 ounces (avoirdupois); dissolve by heat, and continue the heat until red or yellow vapors cease to be evolved; decant the clear liquid into a suitable vessel; add distilled water, 4 gallons; pure bicarbonate of potassa, 20 pounds; and boil for 2 hours. The nitro-muriatic acid is made with pure nitric acid (specific gravity 1.45), 21 ounces; pure muriatic acid (specific gravity 1.15), 17 ounces; and distilled water, 14 ounces.

3589. Gilding by Immersion. Dissolve teroxide or terchloride of gold in a solution of pyrophosphate of soda, and dip the article to be gilt in it.

3590. Gilding and Silvering by Amalgams. For these processes *see Nos.* 3532 *to* 3538.

3591. Gold Plating Powder. Wash thoroughly ½ ounce chloride of gold; then add it to a solution of 2 ounces cyanide of potassium in a pint of clean rain water; shake well, and let it stand until the chloride is dissolved. Add 1 pound prepared Spanish whiting, expose to the air till dry, and then put away in a tight vessel for use.

3592. To Apply Gold Plating Powder. Make some gold plating powder into a paste with water, and rub it on the surface of the article with a piece of chamois skin or cotton flannel. The surface of the article should be thoroughly cleansed before applying the plating powder.

3593. Gilding Paste. Metallic surfaces are gilt by rubbing on the following mixture: Terchloride of gold, 36 parts; dissolve in pure water, 36 parts, and mix with a solution of cyanide of potassium, 60 parts, in pure water, 80 parts; shake well, and set by for 15 minutes, then filter. This liquid is thickened with a powder composed of prepared chalk, 100 parts; cream of tartar, 5 parts.

3594. Fire Gilding. This was extensively done before the discovery of the art of electroplating. Many a piece of beautiful workmanship has come down to us from ancient Rome and Greece, gilded, and probably in the same way as we do it now, under the name of fire-gilding. It requires more gold, the coating being thicker, and is therefore more expensive; but it will last longer, and is the more convenient way for gilding coins and small articles. Clean the silver piece, by means of a brush and a little ammonia water, until the surface is evenly bright and shows no tarnish. Take a small piece of gold and dissolve it in about 4 times its volume of metallic mercury, which will in a short time be accomplished and an amalgam formed. (*See Nos.* 3533 *and* 3534.) Put a little of this amalgam on a piece of dry cloth, and rub the silver piece with it on all sides; then place it on a clean stone in a furnace, and heat to the beginning of redness. After cooling it must be cleaned again with a brush and a little cream of tartar, when it will be found beautifully and lastingly gilded.

3595. To Remove the Gilding from Old China. The following method is recommended for removing the remains of gilding from old china: Take soft water, 8 parts by measure; nitric acid, 8 parts; common salt, 4 parts; sal-ammoniac, 1 part. Let it boil, put the china into it, and rub with a stiff brush.

3596. Wernicke's Method of Gilding Glass. The following are the ingredients required: 1st. Solution of gold. Pure gold, free from silver, is dissolved in aqua regia, the solution evaporated, and the residue taken up with water, so that 120 cubic centimeters (1 gill) contain 1 gramme (15.4 grains) of gold. 2d. Solution of sodic hydrate (which need not be absolutely pure) of 1.06 specific gravity. 3d. Reducing liquid. 50 grammes (771½ grains) sulphuric acid (monohydrate), 40 grammes (617 grains) alcohol, 35 grammes (539 grains) water, and 50 grammes powdered manganic peroxide, are distilled into 50 grammes of water until the bulk of the latter is doubled—10 grammes (154 grains) cane-sugar, inverted by dissolving in 70 cubic centimeters (⁶⁄₁₀ gill) water, and boiling with ½ gramme, (7½ grains) nitric acid of specific gravity 1.34. The distilled liquid, the inverted sugar, and 100 cubic centimeters (⁸⁴⁄₁₀₀ gill) alcohol are mixed together, and the mixture diluted to 500 cubic centimeters (1 ¹⁄₁₀ pints). In using these solutions, 1 volume of the sodic hydrate solution is mixed with 4 volumes of the gold solution, and to this mixture is added from 1.35 to 1.30 volume of the reducing liquid. The object to be gilded is placed on the top of the solution, having the surface intended to be coated turned downwards. The temperature of the bath should be below 140° Fahr.

3597. Boettger's Method of Gilding Glass. Boettger has modified Wernicke's process for throwing down gold on glass as follows: He prepares the soda solution by dissolving 6 grammes (92½ grains) caustic soda in 100 cubic centimeters ($\frac{84}{100}$ gill) water; the reducing fluid, to be made when washed, by dissolving 2 grammes (31 grains) common starch-sugar (glucose) in 24 grammes (370 grains) distilled water, and adding 24 cubic centimeters (⅕ gill) alcohol of 80 per cent., 24 cubic centimeters aldehyde of .870 specific gravity: neutral solution of chloride of gold, 1 gramme (15.4 grains) of gold in 1,200 cubic centimeters (2½ pints) water. Four volumes of the gold solution are mixed in a suitable vessel with one volume soda solution and 1.16 volumes of the reducing liquid, and the liquid rapidly poured into the hollow glass globe to be plated. Five minutes is sufficient to insure the deposit of a thin film of gold, but it is better to allow more time. Flat plates of glass can be laid upon the surface of the liquid, as in the silvering process; the surfaces of the glass should be carefully cleaned with soda and alcohol, and not with acids. The greater part of the gold is thrown down in flocculi, and can be recovered for subsequent use—the amount deposited upon the glass being very small. The mirrors are to be well washed and dried in the air. Where the baths are heated, the deposition of gold takes place more rapidly, but not so fine; it is better to keep the temperature below 140° Fahr; and to allow the metal coating to form slowly.

3598. Upton's Gold Detergent. Quicklime, 1 ounce; sprinkle with a little hot water to slack it, then gradually add 1 pint boiling water, so as to form a milk; dissolve 2 ounces pearlash in 1½ pints boiling water; mix the two solutions, cover up, agitate occasionally for an hour, allow it to settle, decant the clear, put it into flat half-pint bottles, and cork them down well. It is used to clean gilding, &c., either alone or diluted with water. It is applied with a soft sponge, and then washed off with clean water. It is essentially a weak solution of potassa, and may be extemporaneously prepared by diluting liquor of potassa with about 5 times its volume of water.

3599. Gruene's Method of Gilding and Silvering Silk. By a formula published by Gruene, for silvering or gilding silk, the silk is to be soaked with a 5 per cent. solution of iodide of potassium, and dried; then (in non-actinic light, *see No.* 3140), dipped in a 5 per cent. solution of nitrate of silver, containing a few drops of nitric acid, and well drained; next exposed for a few minutes to sunlight, and then dipped in a 2 per cent. solution of sulphate of iron. It immediately becomes gray, from reduction of metallic silver, and, after washing and drying, only requires burnishing in order to acquire the metallic lustre. By repeating this treatment, varied, however, by adding a little free iodine to the solution of iodide of potassium, the silver deposit becomes stronger. By laying the silvered silk in a very weak solution of chloride of gold, the silver becomes chloride, and gold is deposited; and by then removing the chloride of silver by a solution of hyposulphite of soda, washing, drying, and burnishing, the appearance of gilding is produced, if the deposit of metal be sufficiently thick. The purest chemicals must be used in all gilding processes, in order to secure satisfactory results.

3600. Silvering Powder. Employed for silver coating dial plates, statuettes, and other articles of copper, and covering the worn parts of plated goods, previously well cleaned, by friction. They are made into a paste with a little water, for use.

3601. To Make Silvering Powder. Rub together to a fine powder 20 grains fine silver dust (*see No.* 3217), 30 grains alum, 1 drachm common salt, and 3 drachms cream of tartar; 35 grains of nitrate of silver may be substituted for the silver dust. Or: Dissolve chloride of silver in a solution of hyposulphite of soda, and make into a paste with levigated burnt hartshorn or bone dust; dry and powder it. Or: mix 1 ounce silver dust, 4 ounces each of common salt and sal-ammoniac, and ¼ ounce corrosive sublimate. In using the last, copper utensils are previously boiled with tartar and alum, and rubbed with this paste, then made red-hot, afterwards polished. Lastly: A good silvering powder may be made as follows: dissolve chloride of silver in a solution of hyposulphite of soda, and mix this with prepared hartshorn or other suitable powder.

3602. Novargent. This is said to consist of a solution of fresh precipitate chloride of silver in hyposulphite of soda (or, according to the Pharmaceutical Journal, of oxide of silver in cyanide of potassium), mixed with prepared chalk.

3603. Silvering Paste. Nitrate of silver, 1 part; cyanide of potassium (Liebig's), 3 parts; water sufficient to form a thick paste. Apply it with a rag. A bath for the same purpose is made by dissolving 100 parts of sulphite of soda, and 15 of nitrate of silver, in water, and dipping the article to be silvered into it.

3604. Silvering Solution. Prepare a solution of 1 part cyanide of potassium in 6 parts water; add it to a concentrated aqueous solution of nitrate of silver (free from acid) until the precipitate is redissolved. Mix this solution with fine chalk, and apply after previous cleaning of the objects.

3605. Non-poisonous Silvering Fluid. Nitrate of silver, 80 parts; dissolve in distilled water, 36 parts; add sal-ammoniac, 40 parts; hyposulphite of soda, 160 parts; and lastly, whiting, 160 parts. Apply in the usual way.

3606. Silver Plating Fluid. Dissolve 1 ounce crystals of nitrate of silver in 12 ounces soft water. Then dissolve in the water 2 ounces cyanide of potassium. Shake the whole together and let it stand till it becomes clear. Have ready some half-ounce phials, and fill them half full of Paris white, or fine whiting, and then fill up the bottles with the liquid, and it is ready for use. The whiting does not increase the coating power; it only helps to clean the articles, and to save the silver fluid by half filling the bottles. This is the preparation commonly vended by peddlers.

3607. Silver Solution for Plating Copper, Brass, and German Silver. Cut into small pieces a twenty-five cent piece, and put it into an earthen vessel with ½ ounce nitric acid. Put the vessel into warm water, uncovered, until it dissolves. Add ½ gill of water and 1 tea-spoonful of fine salt, and let it settle. Drain off and repeat, adding water to the sediment until the acid taste is all out of the water. Add finally about 1 pint of water to the sediment, and 4 scruples cyanide of potassium. Put into the solution a piece of zinc about 2 inches long, 1 wide, and ⅛ in thickness. After cleaning, immerse the article to be plated in the solution about half a minute, letting it rest on the zinc. Wipe off with a dry cloth and repeat once. Polish with buckskin. The thickness of plate can be increased by repeating.

3608. Silvering Hooks and Eyes. A patent has been granted in Bavaria, for the following method of silvering hooks and eyes made of iron ware. The articles are suspended in dilute sulphuric acid until the iron shows a clean bright surface. After rinsing in pure water, they are placed in a bath of a mixed solution of sulphate of zinc, sulphate of copper and cyanide of potassium, and there remain until they receive a bright coating of brass. Lastly, they are transferred to a bath of nitrate of silver, cyanide of potassium and sulphate of soda, in which they quickly receive a coating of silver.

3609. To Plate Common Copper Buttons. Mix 2 ounces chloride of silver, 1 ounce corrosive sublimate, 3 pounds table salt, and 3 pounds sulphate of zinc, with water, into a paste. The buttons are cleaned, smeared over with the mixture, and exposed to a moderate degree of heat, which is afterwards raised nearly to redness, to expel the mercury which has united with the silver from the corrosive sublimate. The silvered surface is then cleaned and burnished.

3610. Simple Process for Silvering. This is an improved process for silvering copper, brass, and other alloys, by means of a solution of silver in cyanide of potassium; the difference from the usual method consists in the use of zinc-filings, with which the objects are coated; when the silvering solution is applied, an immediate deposition of a much more durable character taking place. The filings are easily removed by rinsing in water, and may be used repeatedly for the same purpose. Metallic iron may be coated with copper in the same manner, by substituting for the silver a solution of copper in cyanide; and over this copper deposit a coating of silver may be applied.

3611. Cold Silvering. Mix 1 part chloride of silver with 3 parts pearlash, 1½ parts common salt, and 1 part whiting, and rub the mixture on the surface of brass or copper (previously well cleansed), by means of a piece of soft leather or a cork moistened with water and dipped into the powder. 1 part precipitated silver powder, mixed with 2 parts each cream of tartar and common salt, may also be used in the same way. When properly silvered, the metal should be well washed in hot water slightly alkalized, and then wiped dry.

3612. Spencer's Method of Silvering Wood. The first operation is to take strong alcohol or spirits of turpentine in a glass vessel, and add to it a piece of phosphorus (a common corked phial will answer the purpose); the vessel must now be placed in hot water for a few minutes, and occasionally shaken; by this means the alcohol will take about 3 per cent. of its bulk of phosphorus. Next procure a weak solution of nitrate of silver, place it in a flat dish or saucer; the face of the wood must now be dipped in this solution, and let it remain a few minutes to allow capillary attraction to draw it into the wood. This operation being performed, a small portion of the solution of phosphorus must be placed in a capsule or watch-glass, and this placed on a sand-bath, that it may gradually evaporate. The wood must now be held with its surface over the vapor, and an immediate change takes place; the nitrate of silver is decomposed, and gives place to metallic silver. When the material to be acted on is not very large, fasten it to the top of a bell-glass receiver with a bit of pitch or cement, and place this over the capsule on the sand-bath; the phosphorus vapor is by this means equally diffused, and not dissipated. A solution of phosphorus in sulphuric ether also answers; and a solution of gold (chloride) may be used. This elegant process, as applied to wood and those substances which may be wetted with the solution of nitrate of silver, answers perfectly; but it is obviously limited in its application to those substances which will absorb an aqueous solution.

3613. Silvering Glass. Two distinct methods are adopted for this purpose. The one falsely called silvering, consists of the application of a layer of an amalgam of tin, or similar alloy, to the surface of the glass (*see No.* 3614), the other is a coating of real silver, precipitated from a solution of that metal. (*See Nos.* 3615, *&c.*)

3614. To Silver Looking-Glasses. This is usually done by coating the glass with an amalgam. For this purpose a large, perfectly flat stone table is provided; upon it is evenly spread a sheet of tin foil without crack or flaw; this is covered uniformly to the depth of ⅛ inch with clean mercury. The plate of glass, perfectly cleansed from all grease and impurity, is floated on to the mercury carefully, so as to exclude all air bubbles. It is then pressed down by loading it with weights in order to press out all the mercury which remains fluid, which is received in a gutter around the stone. After about 24 hours it is raised gently upon its edge, and in a few weeks it is ready to frame. It is said to be desirable to have the lower end of the glass, from which the mercury was drained, at the bottom of the frame. To convex and concave mirrors the amalgamated foil is applied by means of accurately fitting plaster moulds. The interior of globes is silvered by introducing a liquid amalgam, and turning about the globe till every part is covered with it. (*See Nos.* 3538 *and* 3545.)

3615. To Silver Glass. An easy and economical process. Mix 90 parts by measure of a solution of Rochelle salts at 1.50 specific gravity, with 900 parts distilled water, and boil them in a flask; drop in carefully 20 parts of a solution of nitrate of silver specific gravity 1.18, and boil again. This solution can be bottled and kept for any length of time. Another fluid has to be prepared by adding ammonia to a solution of nitrate of silver until the precipitate is entirely dissolved; filtering and diluting 1 part of it with 100 parts of water. For use, put equal parts of the two preparations in a suitable vessel, clean the glass well (*see No.* 3621), and immerse it in the mixture until sufficiently coated. The coating of silver should be protected with a coat of lac varnish.

3616. Drayton's Process for Silvering Glass. Mr. Drayton mixes 1 ounce nitrate of silver, 3 ounces water, 1 ounce liquid ammonia, and 3 ounces spirit of wine, and filters the solution after it has stood 3 or 4 hours. To every ounce of the solution he adds ¼ ounce sugar (grape sugar if possible), dissolved in equal quantities of water and alcohol. The surface to be silvered is covered with this liquid at a temperature of 100° Fahr., maintained till the deposition of silver is complete. When quite dry, the coated surface is covered with mastic varnish. Other substances besides sugar occasion the deposition of silver from the ammoniacal solution; as oil of cassia, oil of cloves, and other essential oils, aldehyde, &c. Unger recommends a strong alcoholic solution of tannin. He had accidentally mixed in a dish a small quantity of a thick alcoholic solution of tannin with an equally small quantity of a strong solution of nitrate of silver; and in the course of a short time he found the dish coated with a thin, brilliant, and uniform layer of metallic silver. He directly repeated the experiment, and met with the same result again and again. He next proceeded to evaporate the liquid to dryness by placing the dish on the surface of warm sand. As soon as it was completely dry, the coating was found to be so fast on the porcelain that it required the point of a sharp penknife to scrape it off. He also succeeded in producing a brilliant metallic coating from a saturated solution of sulphate of copper by the same solution of tannin.

3617. Pettijean's Process of Silvering Glass. Two solutions are to be prepared. The *first* is composed of 26½ drachms nitrate of silver and 2 ounces aqua ammonia, dissolved in 1 pint of distilled water. After filtration this liquor is diluted with 16 times its volume of distilled water, and, drop by drop, a solution of 116¼ grains of tartaric acid is added.

The *second* is prepared in the same manner, but with a double quantity of tartaric acid. As these solutions are rapidly reduced, prepare in the morning the liquors to be used during the day. Before silvering, the glass is perfectly cleaned, first with chalk and a fine cloth, then with a bung and a little of the first solution. It is then rubbed dry with a piece of chamois leather. (*See No.* 3621.) The glass, laid horizontally upon a table of cast iron, at a perfect level, is heated (by means of a cast iron water-bath beneath) to 113° Fahr., an India-rubber roller dipped in distilled water is next passed over its surface, and then its surface is covered with No. 1 solution. The deposit of silver commences in about 10 minutes, and is completed in about 15 minutes afterwards. The glass is then tilted up so as to allow the liquor to run off, and rinsed with water rather more than lukewarm to carry away the non-adherent powder. It is then restored to its horizontal position and covered with solution No. 2. In a quarter of an hour the deposit is completed. The next thing is to wash the plate as before, and dry it, after which it only remains to polish and burnish the film of silver deposited, in order to make it perfectly smooth, and give closeness to the grain. To cover a three-feet square of glass requires 5 pints of liquor. The deposit is, therefore, about 1½ drachms to every 9 square feet. To preserve the coating of silver from sulphuration and rubbing, it is covered with a paint made with 1 pound of lead pigment, 1½ ounces of drying oil, and 5½ ounces of spirits of turpentine. Liebig has produced the same result by depositing on the silver a coating of galvano-plastic copper, but the advantages resulting from the greatest solidity of the deposit scarcely compensate for the practical inconveniences of the process.

3618. To Silver Specula and Other Glass Surfaces. Make a solution of ammonio-nitrate of silver, of the strength of three grains to the ounce. Render it very slightly turbid by excess of nitrate of silver, and then filter it. Just before using, add to each ounce of the foregoing solution 2½ grains of Rochelle salts. Having scrupulously cleaned the glass intended to be silvered (*see No.* 3621), place it in a convenient vessel about one inch from the bottom, supported on three little cones of white wax. The glass plate may be suspended; but in that case there is more difficulty in avoiding vibration, the absence of which is essential to success. Expose to a northern light, or any other subdued light, and in about two hours the deposit of silver will be sufficiently thick. It must now be carefully removed, washed, and dried. When the surface next the glass is to be used as the reflector, the glass side should be cleaned by nitric acid if the state of its surface, after the silvering, so require; and the silvered side should receive a protecting coating of a good tough black varnish.

3619. Liebig's Process for Silvering Glass Mirrors. The process of silvering glass generally rests on the reduction of metallic silver from a solution by means of glucose or some other organic substance. By Liebig's method the deposit of silver is produced by the action of a mixture consisting of 50 parts by measure of a silver solution, and 10 parts of a reducing solution, this latter previously diluted with 250 to 300 parts water. The components of the silver solution are: 140 parts of a solution containing 10 per cent. of nitrate of silver; 100 parts of a solution of nitrate of ammonia (free from chlorine) of 1.115 specific gravity (or a solution of sulphate of ammonia of specific gravity 1.105–1.106;) lastly, 750 parts of caustic soda lye of specific gravity 1.050. In case sulphate of ammonia is used, its solution must be added to the silver solution, not as in the case of nitrate. The reducing solution consists of 1 part by measure of sugar liquor and 1 part of copper liquor.

The *sugar liquor* is prepared by dissolving 50 grammes (771½ grains) white sugar in water to a thin syrup, kept for 1 hour at a boiling heat with $3\frac{1}{10}$ grammes (48 grains) tartaric acid; the solution is then diluted to measure 500 cubic centimeters ($1\frac{1}{10}$ pints).

The *copper liquor* consists of a solution of $2\frac{857}{1000}$ grammes (44 grains) dry tartrate of copper in water, by the aid of a caustic soda solution added by drops until the blue salt is dissolved; the whole is then diluted with water to measure 500 cubic centimeters ($1\frac{1}{10}$ pints).

The glasses to be silvered, if for mirrors, are placed upright on their edge in the silvering tank and held together in pairs by clamps; when for optical purposes, they are held in a horizontal position, just touching the surface of the fluid. In cold seasons the temperature must be kept at 68° to 84° Fahr. The quantity of silver necessary for a square yard of surface is from 46 to 54 grains.

3620. Bird's Process for Silvering Mirrors or Specula. The mirror or speculum to be silvered is first cleaned (*see No.* 3621), and then suspended, face downwards, in a silver bath prepared thus: A large flat shallow vessel of glass or porcelain is provided, to contain the solution. 750 grains nitrate of silver are dissolved in 6 ounces distilled water, and to this is added pure liquid ammonia, drop by drop, until the precipitate which is thrown down is redissolved. 2 ounces caustic potash are dissolved in 50 ounces, by measure, of rain water; and 15 ounces of this solution are added to the ammoniacal solution, when a brown-black precipitate will be produced. Ammonia is again added, drop by drop, until this precipitate is just redissolved; and 29 ounces of distilled water are then added to the whole. To this mixture is again added, drop by drop, stirring with a glass rod, a strong solution of nitrate of silver, until a precipitate, which does not redissolve, begins to be formed. Previous to immersing the speculum, 1 part, by weight, of powdered milk sugar to 10 parts, by measure, of distilled water, must be prepared in a separate vessel, and filtered until a clear solution is obtained. Then, to 10 parts, by measure, of the silvering solution, must be added 1 part, by measure, of the milk sugar solution, and, finally, 50 ounces of the compound solution will be sufficient to silver a speculum 9 inches in diameter. To facilitate the suspending, a circular block of wood is very firmly cemented to the back of the speculum with marine glue or pitch, and three pins inserted at equal distances round the margin, to which strings may be fastened. On lowering it into the bath, care must be taken that no air bubbles intervene, that the speculum be not deeper in the liquid than half its thickness, and that a depth of 2 inches, at least, intervene between the face of the speculum and the bottom of the vessel. In 10 minutes after immersion a metallic film will be seen forming on the glass, and in an hour or two a compact silver coating will be laid over the whole surface. The speculum should remain in the bath for 4 hours, by which time the process is completed; it is then carefully removed, copiously washed with distilled water, and placed on its edge to dry. It is then ready for polishing. (*See No.* 3622.)

3621. To Clean the Surface of Glass for Silvering. As the success of the silvering process depends greatly on the glass surface being made chemically clean previous to immersion in the bath, the utmost pains must be taken to accomplish this object. The surface is first covered with thick whiting cream, free from grit, which, when dry, is rubbed off with the purest cotton wool. The surface is then wetted entirely with dilute nitric acid, and afterwards thoroughly washed with distilled water poured over it; and, last of all, the piece of coated glass is suspended in a flat vessel containing alcohol, where it remains until the bath is ready to receive it.

3622. To Polish a Silvered Surface on Glass. To accomplish this, rub the surface gently, first with a clean pad of fine cotton wool, and afterwards with a similar pad covered over with cotton velvet, which has been charged with fine rouge. The surface will, under this treatment, acquire a polish of intense brilliancy, quite free from any scratches.

3623. To Silver Glass for the Reflectors of Telescopes. The solutions employed are four in number, and they require some care in their first preparation; but once made they are always ready, and can be used with great rapidity and certainty for depositing a lustrous, mirror-like surface of silver on a piece of glass of any desired shape or curvature:—

Solution No. 1 is prepared by dissolving 1 part, by weight, of nitrate of silver, in 10 parts of distilled water.

Solution No. 2 consists of an aqueous solution of pure ammonia, having a density of 13.3° Baumé.

Solution No. 3 consists of 4 parts of pure caustic soda in 100 of distilled water.

Solution No. 4 is made by dissolving $12\frac{1}{2}$ parts of the best white loaf sugar in 100 parts distilled water. To this add 1 part, by measure, of nitric acid, boil for 20 minutes, in order to invert or alter the molecular arrangement of the particles of the sugar, and then add water to increase the volume to 500 parts by measure, and finally add 50 parts alcohol.

These solutions will remain unchanged for a long time. When required for use, prepare a silvering liquid by pouring into a flask 12 parts, by measure, of the silver solution, No. 1; 8 parts, by measure, of the ammoniacal solution, No. 2; then 20 parts of the soda solution, No. 3; and, lastly, add 60 parts of distilled water, in order to make up the volume to 100. If the proportions have been properly observed, the liquid so prepared will be perfectly clear, but will be rendered turbid by the smallest addition of nitrate of silver solution. It must be allowed to remain without disturbance for 24 hours, to permit the floating particles to settle. The clear liquid decanted from the sediment will then be ready for use. The surface of the glass which has to be silvered must be well cleaned with a tuft of cotton and a few drops of nitric acid, and then washed with distilled water. (*See No.* 3621.) Drain it, and support it on the surface of the silvering bath, which is composed of the above described silvering liquid, with the addition of $\frac{1}{10}$ or $\frac{1}{12}$ its volume of the sugar solution, No. 4. The surface to be silvered, should, by preference, be at the upper part of the liquid, so that the silver may be deposited on it from below upward. There are two advantages in this—first, the deposit is finer and more even: and, second, there is no danger of floating particles of dust settling on the surface. It is, however, scarcely necessary to say that silver will be deposited upon every part of the glass which is under the surface of the liquid, as well as upon the sides and bottom of the vessel; so that, as a matter of economy, as little as possible of the back of the glass should be exposed to the action of the liquid. The action seems to be more rapid in the light than in darkness. Under the influence of diffused light the liquid becomes yellow, then brown, and in a few minutes the whole of the exposed surface of the glass will be covered with a fine deposit of silver. In about a quarter of an hour the thickness of the metallic coating will be sufficient to bear the subsequent operations without injury; it must then be washed with plenty of water, and rested by one corner on several thicknesses of blotting-paper to dry spontaneously. The surface will now be covered with a thin whitish veil, which may be readily removed by gentle friction with chamois leather; it may afterwards be polished with jewelers' rouge, when a perfectly brilliant surface will be produced. (*See No.* 3622.)

3624. To Repair the Silvering of Looking-Glasses. The repairing of the silvering on the backs of looking-glasses has hitherto been considered a very difficult operation. A new and very simple method, however, has been described before the Polytechnic Society of Leipsic. It is as follows: Clean the bare portion of the glass by rubbing it gently with fine cotton, taking care to remove any trace of dust and grease. If this cleaning be not done very carefully, defects will appear around the place repaired. With the point of your knife cut upon the back of another looking-glass around a portion of the silvering of the required form, but a little larger. Upon it place a small drop of mercury; a drop the size of a pin's head will be sufficient for a surface equal to the size of the nail. The mercury spreads immediately, penetrates the amalgam to where it was cut off with the knife, and the required piece may now be lifted and removed to the place to be repaired. This is the most difficult part of the operation. Then press lightly the renewed portion with cotton; it hardens almost immediately, and the glass presents the same appearance as a new one.

3625. To Repair a Damaged Mirror. Pour upon a sheet of tin foil about 3 drachms of quicksilver to the square foot of foil. Rub smartly with a piece of buckskin until the foil becomes brilliant. Lay the glass upon a flat table, face downwards; place the foil upon the damaged portion of the glass; lay a sheet of paper over the foil, and place upon it a block of wood or a piece of marble with a perfectly flat surface; put upon it sufficient weight to press it down tight; let it remain in this position a few hours. The foil will adhere to the glass.

3626. Process for Silvering Animal, Vegetable, or Mineral Substances. This process is founded upon the electro-chemical action exercised by certain liquors in which the objects to be silvered are plunged. The method of preparing these liquors is as follows:

Liquor No. 1.—Take 2 parts by weight of caustic lime, 5 of sugar of milk or grape sugar, 2 of gallic acid, and make of them a mixture in 650 parts of distilled water; filter, protect from the air as much as possible, and put in a closely stoppered bottle until the moment of using.

Liquor No. 2.—Dissolve 20 parts nitrate of silver in 20 parts solution of ammonia, and add to this solution 650 parts distilled water. When it is intended to operate, the two preceding liquors are mixed in equal quantities, and, after having been well agitated, filtered. As the solution of ammonia of commerce has not always the same degree of concentration, it would be better, perhaps, to dissolve the nitrate of silver destined for the liquor No. 2, first in distilled water, then mix the solution with liquor No. 1, and then add ammonia in quantity only just sufficient to entirely clear the mixture. The deposition of silver can be accelerated by the employment of heat; in this case, the temperature depends upon the nature of the objects to be submitted to the operation. The method of employing the above liquors in silvering the surfaces of different materials is given in the following six receipts:

3627. To Silver Silk, Woolen, Cotton, Etc. When it is intended to silver silk, woolen, cotton, etc., commence by washing the substance clean; this done, immerse it for a moment in the saturated solution of gallic acid; then withdraw it to plunge it for a second in another solution composed of 20 parts nitrate of silver to 1000 parts distilled water. These alternate immersions are continued, until the substance from being dark becomes of a brilliant tint; after that it is plunged in a bath composed of a mixture of the two liquors, Nos. 1 and 2. (*See No.* 3626.) When it is completely silvered, it is withdrawn and boiled in a solution of salt of tartar (carbonate of potassa) in water, and there remains nothing more to be done but a last washing and drying.

3628. To Silver Bone, Horn, Paper, Etc. Bone, horn, wood, paper, etc., are silvered in the same way (*see No.* 3627) with this difference, however, that, in the place of the alternate immersions above indicated, the objects to be silvered are operated upon with a brush or pencil dipped alternately in the gallic acid solution and in that of nitrate of silver. The silvered surfaces are then washed with distilled water, dried by free air and heat.

3629. To Silver Leather. For leather *tanned with sumach*, in the place of nitrate of silver (*see No.* 3627) the chloride mixed with a few drops of rosemary oil may be employed with advantage. The silvered surface is then washed and dried as directed in last receipt.

3630. To Silver Stucco and Pottery. Stucco and pottery may be silvered by the same process as No. 3628, but before being submitted to the operation they should be covered with a coat of stearine or varnish.

3631. To Silver Glass, Crystal, or Porcelain. To silver glass, crystal, or porcelain, commence by washing thoroughly (*see No.* 3621) the object with distilled water, and with alcohol, and then operate as has been said with the mixture. (*See No.* 3626.) Objects with a plane surface should be placed in a horizontal position, and the liquor poured upon them. (*See Nos.* 3618, *&c.*) When mirrors are to be silvered, the plates of glass may be disposed in a vertical position; place them two and two face against face, in troughs of gutta percha, taking care to prevent all contact with the sides; then fill with the liquid. Precipitation of silver commences in a quarter of an hour, and at the end of a few hours the operation is finished. When dry, coat the silvered surface with varnish.

3632. To Silver the Metals. Commence by cleansing them with nitric acid; rub them afterwards with a mixture of cyanide of potassium and powdered silver; then, after washing with water, they are plunged alternately into the liquors Nos. 1 and 2 (*see No.* 3626), until they appear sufficiently silvered. If working with iron, it should be first immersed in a solution of sulphate of copper. The process which has been described presents above all others the advantage of very solid results, and of employing chemical agents of low price.

3633. To Coat Copper Plates with Brass. Expose the plates, heated sufficiently, to the fumes of zinc. Zinc boils and is vaporized by heating it to a white heat.

3634. To Coat the Inside of Copper Vessels with Brass. Dissolve 1 part zinc amalgam (*see No.* 3539) in 2 parts muriatic acid; add 1 part argol (crude tartar), and add sufficient water to fill the vessel; then boil it in the vessel.

3635. To Deposit Copper upon Cast Iron. The pieces of cast iron are first placed in a bath made of 50 parts hydrochloric acid, specific gravity 1.105, and 1 part nitric acid; next, in a second bath, composed of 10 parts nitric acid, 10 parts of chloride of copper, dissolved in 80 parts of the same hydrochloric acid as just alluded to. The objects are rubbed with a woolen rag and a soft brush, next washed with water, and again immersed until the desired thickness of copper is deposited. When it is desired to give the appearance of bronze, the copper surface is rubbed with a mixture of 4 parts salammoniac and 1 part each oxalic and acetic acids dissolved in 30 parts water.

3636. Graeger's Process for Covering Iron and Steel with Copper without a Battery. The objects are first well cleaned, and then painted over with a solution of protochloride of tin, and immediately afterward with an ammoniacal solution of sulphate of copper. The layer of copper thus produced adheres so firmly to the iron or steel, that the different objects can be rubbed and polished with fine chalk without injuring the deposit. The *tin solution* is prepared with 1 part crystallized chloride of tin, 2 parts water, and 2 parts hydrochloric acid. The *copper solution*, with 1 part sulphate of copper, 16 parts water, adding ammonia sufficient to redissolve the precipitate first thrown down by it. Zinc and galvanized iron can be treated, according to Boettger, directly by the copper solution, without using the tin salt. The above process may be found useful by gilders, and for various ornamental purposes.

3637. Weil's Process for Coating Iron with Copper. This process yields a coating of copper of great brightness and strong cohesion. The object, whether of cast or wrought iron, is freed from rust by immersion for from 5 to 10 minutes in water containing 2 per cent. of muriatic acid, and subsequent scrubbing for ¼ hour with a wire brush and sand, then washing in water until all traces of acid are removed. It is then covered with zinc wire in spiral turns of about 6 inches from each other, which also serves as a means of suspension. The bath consists of a solution of 8 parts caustic soda in 100 parts water, of which 11 quarts are mixed with 50 ounces Rochelle salts and 12½ ounces sulphate of copper, making a liquid of a density equal to 19° Baumé. It retains its activity as long as the copper is kept replaced, and deposition from it proceeds with great regularity. The material of the vessel is best when made of wood, lined with gutta-percha, and covered with a wooden lid. When the coating is of sufficient thickness, the object is removed from the bath, first washed with water slightly acidified with sulphuric acid, and then with pure water until the disappearance of all traces of acid; after this it passes into a drying room heated to 132° Fahr. The bronzing, when required, is obtained by a bath of sulphide of sodium, or by means of the same bath as above, somewhat modified, that is, by increasing the proportion of copper to a threefold, in which case the bath no longer deposits copper, but, to all appearances, bronze. By reducing the points of contact between the iron and wire, though retaining the spiral turns at uniform distances, the deposit gradually assumes a number of colors in the following series, viz.: orange, silver-white, pale yellow, golden yellow, carmine, green, brown, and dark bronze. As soon as the desired color is attained, the object is washed in warm water, and again dried at 132°. Between each subsequent change of color is an interval of about 5 minutes. The reaction is more decided when the alkaline reaction of the bath is stronger. For indoor work or ornaments the time of immersion may vary from 3 to 72 hours; for outdoor objects a much longer time would be necessary.

3638. To Tin Iron Pots and other Domestic Articles. The articles are cleaned with sand, and, if necessary, with acid, and put then in a bath, prepared with 1 ounce cream of tartar, 1 ounce tin salt (protochloride of tin), 10 quarts water. This bath must be kept at a temperature of 190° Fahr., in a stoneware or wooden tank. Bits of metallic zinc are put into and between the different pieces. When the coat of tin is considered thick enough, the articles are taken out of the fluid, washed with water, and dried.

3639. To Tin by the Moist Way. Make a solution of 1 part protochloride of tin in 10 parts water, to which add a solution of 2 parts of caustic soda in 20 parts water; the mixture becomes turbid, but this does not affect the tinning operation, which is effected by heating the objects to be tinned in this fluid, care being taken, at the same time, to place in the liquid a piece of perforated block tin plate, and to stir up the fluid during the tinning with a rod of zinc.

3640. To Tin Iron Without the Aid of Heat. To 105 quarts water are added 6½ pounds rye meal; this mixture is boiled for 30 minutes, and next filtered through cloth; to the clear but thickish liquid are added 233 pounds pyrophosphate of soda, 37½ pounds protochloride of tin in crystals (so-called tin salt), 147½ pounds neutral protochloride of tin, 3½ to 4 ounces sulphuric acid; this liquid is placed in well made wooden troughs, and serves more specially for the tinning of iron and steel wire (previously polished) for the use of carding machines. When, instead of the two salts of tin just named, cyanide of silver and cyanide of potassium are taken, the iron is perfectly silvered.

3641. To Cleanse Iron for Tinning. The metal must be cleansed by immersion in an acid solution; for new metal, this solution should be sulphuric acid and water, but for old metal, muriatic acid and water; next scour with sand, and cleanse well with water.

3642. To Tin Iron. First cleanse as above, then heat the article just hot enough to melt the tin, rub the surface over with a piece of sal-ammoniac, and sprinkle some of the sal-ammoniac in powder over it; then apply the tin and wipe it over evenly with a piece of tow.

3643. Cold Tinning. Rub pure tinfoil and quicksilver together until the amalgam becomes soft and fusible, clean the surface to be tinned with spirits of salt (hydrochloric acid), and, while moist, rub the amalgam on, and then evaporate the quicksilver by heat.

3644. Stolba's Method of Tinning Copper, Brass, and Iron in the Cold, and without Apparatus. The object to be coated with tin must be entirely free from oxide or rust. It must be carefully cleaned, and care be taken that no grease spots are left; it makes no difference whether the object be cleaned mechanically or chemically. Two preparations are requisite for the purpose of tinning. *Zinc powder*—the best is that prepared artificially by melting zinc and pouring it into an iron mortar. (*See No.* 3312.) It can be easily pulverized immediately after solidification; it should be about as fine as writing sand. *A solution of protochloride of tin,* containing 5 to 10 per cent., to which as much pulverized cream of tartar must be added as will go on the point of a knife.

The object to be tinned is moistened with the tin solution, after which it is rubbed hard with the zinc powder. The tinning appears at once. The tin salt is decomposed by the zinc, metallic tin being deposited. When the object tinned is polished brass or copper, it appears as beautiful as if silvered, and retains its lustre for a long time. This method may be used in a laboratory to preserve iron, steel, and copper apparatus from rust; and would become of great importance if the tinning could be made as thick as in the dry way, but this has not as yet been accomplished.

3645. To Tin Copper Tubes. W. Wollweber recommends for still-worms copper tubes tinned inside in the following manner: To a solution of Rochelle salts a solution of salts of tin is added; a precipitate of stannous tartrate is formed, which is washed and then dissolved in caustic lye. The copper tube, which has first been rinsed with sulphuric acid and then washed, is then filled with the alkaline solution, warmed a little, and touched with a tin rod, which causes the deposition of a coat of metallic tin.

3646. To Tin a Worn Copper Kettle. A thick coating may be obtained by preparing a tinning solution of zinc dissolved in muriatic acid, making the solution as thick or heavily charged with zinc as possible, adding a little sal-ammoniac. Clean the inside of the kettle, place it in a charcoal fire until a piece of block tin placed inside melts, then rub the melted tin with some of the tinning solution, quickly on the copper surface, by means of a ball of oakum and a little powdered resin; the tin will readily adhere. Wrought iron and steel may be tinned in the same manner.

3647. To Tin a Copper Vessel. Boil the copper vessel with a solution of stannate of potassa mixed with tin borings, or boil with tin filings and caustic alkali or cream of tartar. In a few minutes a layer of pure tin will be firmly attached.

3648. To Tin Cast Copper or Brass. Make a saturated solution of oxide of tin (*tin putty*), in potash lye; add to the solution some tin filings or shavings; make it as hot as possible; then introduce the brass or copper and it will be tinned in a few seconds.

3649. To Galvanize Iron. The difference between galvanized plates, so-called, and "sheet-tin," is, that the latter is sheet-iron covered with a thin coating of block-tin, while the former is sheet-iron covered with a thin coating of zinc. To effect the latter result, the iron plates are first immersed in a *cleansing bath* of equal parts of sulphuric or muriatic acid and water, used warm. (*See No.* 3266.) They are then scrubbed with emery or sand, to clean them thoroughly and detach all scales, if any are left; after which they are immersed in a *preparing bath* of equal parts of saturated solutions of chloride of zinc and chloride of ammonium, from which bath they are directly transferred to the fluid *metallic bath,* consisting of 20 chemical equivalents of zinc to 1 of mercury; or, by weight, 640 pounds of zinc to 106 of mercury, to which are added from 5 to 6 ounces of sodium. As soon as the iron has attained the temperature of this hot fluid bath, which is only 680° Fahr., it may be removed, and will then be found thoroughly coated with zinc. Care must be taken not to leave the plates too long immersed in this bath, as its affinity for iron is such that they may become dissolved. This is the case with thin plates of wrought-iron, which, even when ⅛ inch thick, may be dissolved in a few seconds. It is safe, therefore, to let the bath previously act on some wrought-iron, so that it dissolves a portion of it, in order to satisfy its inconveniently great affinity for this metal.

3650. To Zinc or Galvanize Grey Iron Castings. Cleanse the articles in an ordinary chafing mill, which consists of a barrel revolving on its axis containing sand; when the sand is all removed, take them out and heat one by one, plunging, while hot, in a liquid composed as follows: 10 pounds hydrochloric acid, and sufficient sheet zinc to make a saturated solution. (*See No.* 3473.) In making this solution, when the evolution of gas has ceased, add muriate, or preferably sulphate of ammonia, 1 pound, and let it stand until dissolved. The castings should be so hot that when dipped into this solution, and instantly removed, they will immediately dry, leaving the surface crystallized like frost-work on a window pane. Next plunge them while hot, but perfectly dry, into a bath of melted zinc, previously skimming the oxide on the surface away, and throwing thereon a small amount of powdered sal-ammoniac. If the articles are very small, inclose them in a wrought-iron basket on a pole, and lower them into the metal. When this is done, shake off the superfluous metal, and cast them into a vessel of water to prevent them from adhering when the zinc solidifies.

3651. To Zinc Copper or Brass Vessels. Boil the vessel in a solution of chloride of zinc, adding a quantity of zinc turnings to the solution.

3652. Boettger's Process for Coating Copper and Brass with Zinc by a Wet Process. Place zinc in grains or powder in a non-metallic vessel, and cover the zinc with a concentrated solution of sal-ammoniac; warm to ebullition, and introduce into the mixture the objects of copper or of brass which it is desired to coat, after having properly cleansed them. After a few minutes, the object will be covered with a brilliant, firmly adhering deposit of zinc. (*See No.* 3312.)

3653. To Coat Copper with Zinc. To granulate the zinc, a clean surface of copper may be coated with zinc by placing the two metals in contact in a solution of caustic soda or potash. (*See Fig. I., No.* 3665.) In the cold the deposit of zinc takes place slowly, but at 100° it is effected rapidly.

3654. Purcher's Method of Coating Zinc with Iron. Dissolve 5 ounces pure sulphate of iron, and 3 ounces sal-ammoniac, in 5 pounds of boiling water, and immediately immerse the objects to be treated. After from 1 or 2 minutes the loose black deposit is removed by brushing it off with water. The principal effect of this operation is a perfect cleaning of the surface. The immersion in the hot iron solution is then repeated, with the difference that the objects, when taken out, are heated, without rinsing, over a pan of live coals as long as the ammoniacal vapors are evolved. When, after several immersions, the coating is considered thick enough, it is polished by brushing, and will ever afterward be a perfect protection against oxidation. It imparts a fine black lustre to the coated surfaces.

3655. Process for Covering Articles of Zinc with Copper or Brass by One Immersion. To give zinc a coat of copper or brass for the purpose of a subsequent silvering or gilding, the following solutions are used: For copper alone, a solution of sulphate of copper, saturated at the common temperature, is mixed with a solution of cyanide of potassium, adding as much of the latter as is necessary to redissolve the precipitate thrown down at first. The prussic acid disengaged during this operation must be carried off by a draught or flue. When the mixture is clear, $\frac{1}{10}$ or $\frac{1}{6}$ of its volume of water of ammonia is added, and then diluted with water to a density of 8° Baumé. For brass, sulphate of copper and sulphate of zinc are used in equal proportion, and prepared as before. 2 parts sulphate of zinc and 1 of sulphate of copper give a bright brass coating. Previous to their dipping, the articles of zinc are rubbed off thoroughly with finely-powdered pumice-stone and rinsed in water, after which they are placed in the bath and remain there for 24 hours. After that time they are again rinsed in water and simply wiped off. The copper or brass covering has a very bright look, as if polished, and adheres perfectly. The thickness of the coat may be increased afterwards by the aid of a battery.

3656. Dullo's Method of Platinizing Glass. This is recommended to prevent fusing of the thin end of a glass tube used for a blowpipe. In drawing out the end of the tube, leave the diameter slightly larger than is necessary; then roughen the narrow end with a file. Dip in a solution of bichloride of platinum, containing 5 per cent. of the metal; remove excess of the drop, and heat cautiously till the glass acquires a metallic appearance. Repeat this 4 or 5 times.

3657. Boettger's Method of Platinizing Glass. Pour rosemary oil upon the dry chloride of platinum in a porcelain dish, and knead it well until all parts are moistened; then rub this up with 5 times its weight of lavender oil, and leave the liquid a short time to clarify. The objects to be platinized are to be thinly coated with the above preparation and afterwards heated for a few minutes in a muffle or over a Bunsen burner.

3658. Platinizing Copper, Yellow Metal, and Brass. In order to obtain a platinizing fluid capable of platinizing copper, yellow metal, and brass, add to a moderately concentrated solution of chloride of platinum, finely powdered carbonate of soda, until effervescence ceases; next some glucose, and afterwards just so much common salt as will cause a whitish-colored precipitate. When it is desired to apply this mixture for platinizing, the objects to be treated are placed in a vessel made of zinc and perforated with holes; the vessel is then placed, with its contents, for a few seconds in the mixture thus described, which, just previous to using, should be heated to 140° Fahr. On being removed from the zinc vessel, the objects are to be washed with water and dried in sawdust.

3659. Stolba's Method of Nickel Plating. Into the plating vessel—which may be of porcelain, but preferably of copper—is placed a concentrated solution of chloride of zinc, which is then diluted with from 1 to 2 volumes of water, and heated to boiling. If any precipitate separates, it is to be redissolved by adding a few drops of hydrochloric acid. As much powdered zinc as can be taken on the point of a knife is thrown in, by which the vessel becomes covered internally with a coating of zinc. The nickel salt—for which purpose either the chloride or sulphate may be used—is then added until the liquid is distinctly green; and the articles to be plated, previously thoroughly cleaned, are introduced, together with some zinc fragments. The boiling is continued for 15 minutes, when the coating of nickel is completed, and the process is finished. The articles are well washed with water and cleaned with chalk. If a thicker coating be desired, the operation may be repeated. Professor Stolba found that copper vessels thus plated were scarcely tarnished after several months' use in the laboratory.

Electrotyping. This is a process for depositing a coating of metal on objects, metallic or otherwise, by the agency of a current of galvanic electricity. Before entering into any description of the methods employed, it will be necessary to give some indispensable preliminary directions, in order that the whole matter may be more clearly understood. The matter is mainly derived from the 4th edition of Napier's Manual of Electro-Metallurgy.

3661. Solution of Copper for Electrotyping. Crush fine sulphate of copper in crystals, and expose to the air for some time. This oxidizes any iron that may be present. Stir the sulphate of copper into pure cold water, until the water will dissolve no more; then let it settle, and decant the clear solution; add to it about one-fourth its quantity of water, and it is ready for use.

3662. To Amalgamate Zinc. Immerse a plate or strip of zinc of the required size in diluted sulphuric acid, for a few moments; then rub quicksilver over the surface. Whenever the surface of the amalgamated zinc employed in a battery begins to blacken and lose its quicksilver coating, the zinc must be taken out of the acid cell and amalgamated again.

3663. To Keep the Zinc Plates of a Smee's Battery Constantly Amalgamated. The trouble of renewing the coating of amalgam on the zinc plates may be obviated by a very simple contrivance. Cover the bottom of the cell with quicksilver, and let the zinc plates be long enough to dip into it. The silver plate must be a little shorter than the zinc plates, so that it will not touch the mercury. By this arangement the zinc plates draw up the mercury as fast as it is worn off by the action of the acid.

3664. Decomposing Cell. This is a vessel of suitable shape and dimensions, containing the plating or electrotyping solution; and is usually furnished with appliances over it for suspending and sustaining in their proper position the *negative electrodes* or articles to receive the metallic coating, and their corresponding *positive electrodes*, or plates of metal, which serve to complete the electric circuit, and whose decomposition serves to keep up the strength of the solution. The positive electrode must always be of the same metal as that which the solution contains.

3665. The Principles of the Galvanic Battery Explained. If a piece of ordinary metallic zinc be put into dilute sulphuric acid, it is speedily acted upon by the acid, and hydrogen gas is at the same time evolved from its surface. If the zinc be taken out, and a little mercury be rubbed over its surface, an amalgamation takes place between the two metals, and the plate becomes of a beautiful bright silver appearance. If the zinc thus amalgamated be again put into the dilute acid, there is no action, for the mercury retains the zinc with sufficient force to protect it from the acid. If a piece of copper be immersed along with the zinc, and the two metals be made to touch each other, a particular influence is induced among the three elements, zinc, copper, and acid; and the acid again acts upon the zinc as if no mercury was upon it, but the hydrogen is now seen to escape from the surface of the copper; this action will go on as long as the two metals are kept in contact. Or if, instead of causing the two metals to touch, a wire be attached to each, and their opposite ends are placed in a little dilute acid in another vessel, the same action will take place between the zinc and copper as when they were in contact; but in this instance, the ends of the two wires which dip into the vessel containing acid will undergo a change; the one attached to the zinc will give off a quantity of hydrogen gas, while the one attached to the copper, supposing it to be also copper, will rapidly dissolve.

Figure 1. Represents the zinc and copper, placed in dilute sulphuric acid, brought into contact; in this experiment, gas will be seen escaping from the copper.

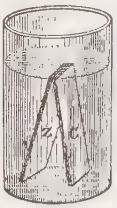


Fig. 1.

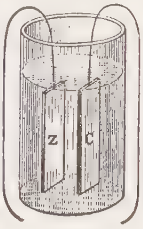


Fig. 2.

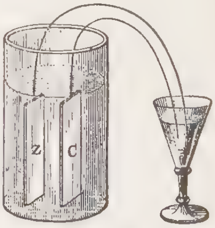


Fig. 3.

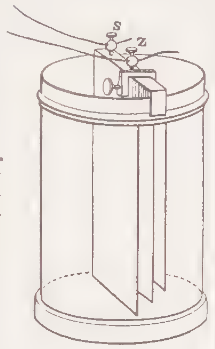
Figure 2. Zinc and copper, placed in dilute acid. and wires attached, which, when connected, will exhibit the same effects as in the first case.

Figure 3. Shows the wires connected by means of a liquid, such as acid and water, sulphate of copper, etc., contained in a wine-glass.

The copper and zinc, c and z, with the acid in the first vessel, figure 3, constitute a battery of one pair. The wine-glass in which the wires are placed, is termed the decomposing cell (*see No.* 3664), and is the receptacle or vessel in which the process of electroplating is effected. The above description will give a tolerably clear idea of the principles of a simple galvanic battery. Different kinds of batteries are only different modifications or applications of the same principles, and have each their special excellence; but for electroplating, Smee's battery is the one usually adopted.

3666. To Construct a Cheap Galvanic Battery. Take a gallon stone jar, and place a sheet-zinc cylinder therein, and inside that a porous cup (a porous flower-pot with a cork fitted in the hole will answer after a fashion). Inside the porous cup place a piece of sheet copper. Use a solution of common salt next the zinc, and a solution of sulphate of copper next the copper in the porous cup, if a strong current be desired. The liquids inside and outside the porous cup should stand at the same level. Dilute sulphuric acid (1 part acid to 10 water) makes a very constant, but weaker current.

3667. Description of a Smee's Battery. This apparatus consists of a vessel containing a mixture of about 15 or 20 (Morfit gives only 7) parts water to 1 part sulphuric acid, provided with a strip of baked and varnished wood, long enough to stand across the edge of the vessel, and grooved lengthways underneath, to receive the edge of a silver plate, to which a short wire is attached and connected through a hole in the wood with a screw cap on the upper side of the wood. Two plates of zinc are arranged, one on each side of the strip of wood, and secured by a screw clamp, the upper part of which is also fitted with a screw cap. The object of the screw caps is to receive and secure the wires connecting with the decomposing cell. The zinc plates must first be coated with amalgam (*see No.* 3662, *also No.* 3663); and the silver plate must be covered with a coating of platina. (*See No.* 3670.) The arrangement of the parts will be seen in the cut. When two or more cells are used in combination, forming a compound battery, the silver plate of the first cell is connected by a wire with the zinc plates of the second; the silver plate of the second cell is connected with the zinc of the third cell; the silver of the third with the zinc of the fourth, and so on through any number of cells. The two wires connecting the battery with the decomposing trough are attached, one to the zinc plates of the *first* cell, and the other to the silver plate of the *last* cell. In fact, the zinc pole of the first, and silver pole of the last cell, really constitute the battery, the intermediate cells each furnishing an additional quota, as it were, of intensity, to the galvanic current.



The wire connected with the zinc (or *positive*) plates is called the *negative* pole or *cathode;* and the wire connected to the silver (or *negative*) plate is called the *positive* pole or *anode.* The material used for connecting wires is usually copper, and should be clean and bright, and in order to insure perfection of contact, the ends of the wire may be amalgamated by dipping, first in a solution of nitrate of mercury, and then in metallic mercury.

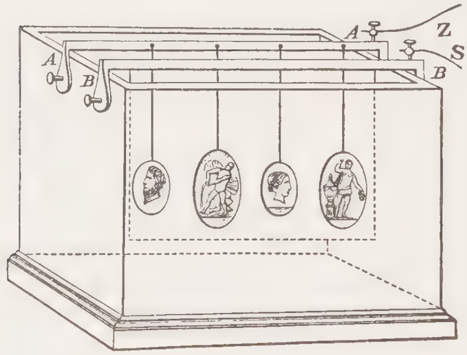
3668. Improved Liquid for the Galvanic Battery. Mr. Victor Barjon's new battery liquid is made by mixing a solution of bichromate of potash with a little lime, and with sulphuric acid. He puts 2 pounds bichromate of potash into a gallon of boiling water, and lets the solution cool down to 68°, and adds 2 ounces of lime. After stirring, he adds sulphuric acid until the gravity reaches 35° Baumé. Then, having stirred the whole, he lets it stand for 24 hours, when it is ready for use.

3669. Electrotyping by the Single Cell Process. This is an adaptation of Daniell's cell to the purposes of electrotyping, and dispenses with any separate decomposing cell; in fact it is a galvanic battery and a decomposing cell combined in one, and is useful, for small objects, from its simplicity. About $\frac{2}{3}$ fill a large jar (a preserve jar without any neck is best), with a solution of sulphate of copper (*see No.* 3661); insert in this a small tubular porous vessel of about the same height as the jar (these porous tubes can be found at any store where chemical apparatus is sold), and pour into it a mixture of 21 parts water and 1 part sulphuric acid, until the diluted acid in the porous tube stands at the same level as the sulphate of copper solution outside it. To one end of a piece of copper wire fasten a strip of amalgamated zinc (*see No.* 3662), which is to be inserted in the porous tube; to the other end of the wire attach the object to be electrotyped, properly prepared (*see No.* 3689), and place it in the copper solution, with its face parallel to the zinc plate, and about ½ an inch from the side of the porous tube. In about 24 hours the deposit of copper will be of about the thickness of a card, and may be taken off. When not in use, the zinc should be taken out, washed and dried; and when in use must on no account touch the bottom or any other part of the porous tube. It is a good plan to give the wire one twist round a stick of wood, laid across the top of the tube, so as to suspend and support the zinc. A few crystals of sulphate of copper, enclosed in a piece of lawn or net, should be hung from the edge of the vessel just below the surface of the copper solution, to replace the copper that deposits on the object being electrotyped, and prevent the solution from becoming weaker.

3670. To Coat Silver with Platina. This is effected by the one cell process, substituting for the sulphate of copper solution, water acidulated with sulphuric acid, and containing a little chloride of platinum. The silver is first roughened on the surface by applying strong nitric acid, and washed; it is then attached to the end of the wire leading from the zinc plate in the porous cell, and immersed in the platinum solution exactly as if it were a medal to be electrotyped, until the surface is covered with a dark and granular deposit.

3671. Electrotyping with a Battery. For this purpose a Smee's battery (*see No.* 3667) is usually employed, in connection with a decomposing cell. (*See No.* 3664.) As the method for electrotyping, or coating with copper, is substantially the same as for other metals, a description of the first will suffice. The decomposing cell being charged with a solution of sulphate of copper (*see No.* 3661), the object, duly prepared (*see No.* 3689), to be electrotyped, is properly secured in position, and connected with the cathode or wire leading from the zinc plates of the battery. To the anode or wire leading from the silver plate, a positive electrode, consisting of a piece of the same metal as the solution contains (in this case, copper), is attached, and immersed in the solution, face to face with the object to be electrotyped; as the copper from the solution is precipitated on the object, the piece of copper is dissolved, and thus keeps up the strength of the solution. Any number of objects may be electrotyped in the same decomposing cell, provided that each is connected with the zinc pole of the battery, and hangs facing a positive electrode. The usual arrangement for this purpose consists of a water-tight trough of suitable size and shape (usually oblong), to contain the copper or other metallic solution, and is provided with metal bars, long enough to reach the length of the trough and rest on the upper edge at each end; the bars rest on dry varnished blocks of wood, and are laid parallel to each other at a distance of 3 or more inches apart, according as the space between them is required. Plates of copper of nearly the same length as the trough are suspended from the bars, and submerged in the solution parallel with them. These bars, and consequently the copper plates (which constitute continuous positive electrodes) are connected with copper wire or ribbons to the anode, or silver pole of the battery. Alternately between these bars, other bars are placed, exactly similarly arranged, but having small projections or buttons on one of their sides, to which the objects to be electrotyped are secured by a wire, and suspended in the solution, face to face with its corresponding copper plate. These latter bars are connnected with the cathode or zinc pole of the battery. It will thus be evident that each contiguous pair of bars are mutually positive and negative electrodes, and the objects on the one must *closely face* the copper plate on the other. The accompanying cut will give some idea of the arrangement of *one pair* of bars.

B B is the bar connected by the wire *S* with the silver pole of the battery, and supporting a plate of copper suspended in the trough. In the cut, the copper is supposed to be transparent, in order that the objects to be electrotyped, suspended from the bar *A A*, may be visible; they are supposed to be *behind* and *closely facing* the copper plate. The bar *A A* is connected by the wire *Z* to the zinc pole of the battery.



3672. To Obtain a Copper Mould of a Coin. A fine copper wire must be put round the edge of the coin and fastened by twisting. Then cover the back part, and the wire, upon which the deposit is not required, with bees' wax or tallow, or, what is better, imbed the back of the coin in gutta percha. Have the fore part or face well cleaned, and the surface moistened with sweet oil, by a camel's-hair pencil, and then cleaned off by a silk cloth, till the surface appears dry; or, instead of oil, the surface may be brushed over with black lead, which will impart to it a bronze appearance. The use of the oil or black lead is to prevent the deposit adhering to the face of the coin. The coin is now ready to be subjected to the single cell process (*see No.* 3669), by which means a perfect counterpart or mould of the coin is obtained. This mould may next be treated exactly as described for obtaining it from the original coin, and the deposit from it will be a fac-simile of one side of the coin. With care, any number of duplicates may be taken from this mould, if it be properly coated.

3673. Coating for Copper Moulds. Take a gill of rectified spirits of turpentine, and add to it about the size of an ordinary pea of bees' wax. When this is dissolved, wet over the surface of the mould with it, and then allow it to dry: the mould is then ready to put into the solution. Medals taken from moulds so prepared retain their beautifully bright color for a long time. But when fine line engravings are to be coated, the little wax dissolved in the turpentine may be objectionable; so also is black lead, for both have a tendency to fill up the fine lines. In this case, let the turpentine wash be wiped off with a silk handkerchief, instead of drying it; but for ordinary medals this objection will scarcely apply.

3674. Preparation of Wax for Taking Moulds. Whether the bees' wax have stearine in it or not, it is best to prepare it in the following manner: Put some common virgin wax into an earthenware pot or pipkin, and place it over a slow fire; and when it is all melted, stir into it a little white lead (flake white), or black lead (plumbago), say about 1 ounce white lead to the pound of wax; this mixture tends to prevent the mould from cracking in the cooling, and from floating in the solution; the mixture should be re-melted two or three times before using it for the first time. Resin has been recommended as a mixture with wax; mixtures of which, in various proportions, have been used with success; but when often used, decomposition or some change takes place, which makes the mixture granular and flexible, rendering it less useful for taking moulds. When resin is used, the mixture, when first melted, should be boiled, or nearly so, and kept at that heat until effervescence ceases; it is then to be poured out upon a flat plate to cool, after which it may be used as described.

3675. To Take Moulds in Wax. The medal to be copied must be brushed over with a little sweet oil: a soft brush, called a painter's sash tool, suits this purpose well: care must be taken to brush the oil well into all parts of the medal, after which the superfluous oil must be wiped off with a piece of cotton or cotton wool. If the medal has a bright polished surface, very little oil is required, but if the surface be matted or dead, it requires more care with the oil. A slip of card-board or tin is now bound round the edge of the medal, the edge of which slip should rise about one-fourth of an inch higher than the highest part on the face of the medal. This done, hold the medal with its rim a little sloping, then pour the wax in the lowest portion, and gently bring it level, so that the melted wax may gradually flow over; this will prevent the formation of air-bubbles. Care must be taken not to pour the wax on too hot, as that is one great cause of failure in getting good moulds; it should be poured on just as it is beginning to set in the dish. As soon as the composition poured on the medal is set (becomes solid), undo the rim, for if it was allowed to remain on till the wax became perfectly cool, the wax would adhere to it, and would be liable to crack from shrinking.

Put the medal and wax in a cool place, and in about an hour the two will separate easily. When they adhere, the cause is either that too little oil has been used, or that the wax was poured on too hot.

3676. To Take Wax Moulds from Plaster. If the object from which the mould is to be taken, which we assume to be a medal, be composed of plaster of Paris, and the mould is to be taken in wax, the first operation is to prepare the plaster medal. Some boiled linseed oil, such as is used by house painters, is to be laid over the surface of the medal with a camel's-hair pencil, and continued until it is perfectly saturated, which is known by the plaster ceasing to absorb any more of the oil. This operation succeeds best when the medal is heated a little. The medal should now be laid aside till the oil completely dries, when the plaster will be found to be quite hard, and having the appearance of polished marble; it is, consequently, fit to be used for taking the wax mould, which is done in the same manner as we have described for taking a wax mould from a metallic medal. (*See No.* 3675.) Many prefer saturating the medal with water. This is best done by placing the medal back down in the water, but not allowing it to flow over the face; the water rises, by capillary attraction, to the surface of the medal, rendering the face damp without being wet. The rim being now tied on the plaster medal, the melted wax is poured upon it. This method is equally good, but liability to failures is much greater, caused generally by the wax being too hot. The plaster medal may be saturated with skimmed milk and then dried; by repeating this twice, the plaster assumes on the surface an appearance like marble, and may be used for taking wax moulds.

3677. To Take Moulds in Plaster. If a plaster of Paris mould is to be taken from the metallic medal, the preparation of the medal is the same as described in No. 3676; and when so prepared with the rim of cardboard or tin, get a basin with as much water in it as will be sufficient to make a proper sized mould (a very little experience will enable the operator to know this), then take the finest plaster of Paris and sprinkle it into the water, stirring it till the mixture becomes of the consistence of thick cream; then pour a small portion upon the face of the medal, and, with a brush similar to that used for oiling it, gently brush the plaster into every part of the surface, which will prevent the formation of air-bubbles; then pour on the remainder of the plaster till it rises to the edge of the rim: if the plaster is good, it will be ready for taking off in an hour. The mould is then to be placed before a fire, or in an oven, until quite dry, after which it is to be placed, back downwards, in a shallow vessel containing melted wax, not of sufficient depth to flow over the face of the mould, allowing the whole to remain over a slow fire until the wax has penetrated the plaster, and appears upon the face. Having removed it to a cool place to harden, it will soon be ready for electrotyping. Glycerine affords an excellent coating for the interior of plaster moulds, to prevent the melted wax from adhering to the inside of the mould.

3678. To Take Moulds of Plaster from Plaster Models. When a plaster mould is to be taken, the face of the model is prepared differently to that described, in order to prevent the adhesion of the two plasters. The best substance for this purpose is a mixture of soft soap and tallow, universally used by potters for preparing their moulds, and called by them lacquer. It is prepared in the following manner: ½ pound soft soap is put into 3 pints clean water, which are set on a clear fire, and kept in agitation by stirring; when the mixture begins to boil, add from 1 to 1½ ounces tallow, and keep boiling till it is reduced in bulk to about 2 pints, when it is ready for use. The surface of the medal must be washed over with this lacquer, allowing it to absorb as much as it can, when it assumes the appearance of polished marble; it is now prepared with a rim of paper, and the mould taken as directed for taking plaster moulds. (*See No.* 3677.) When hardened, they will separate easily. Wetting the plaster model with a solution of soap before taking the cast will do, or, if the plaster model has been saturated with oil or milk, it has only to be moistened with sweet oil the same as a metal model.

3679. To Take Moulds of Fusible Alloy from Plaster Models. If a mould of fusible metal be required from a plaster model, the plaster may be saturated either with boiled oil (*see No.* 3676), or the soap and tallow lacquer (*see No.* 3678), and the mould taken in the same manner as from a metallic medal. (*See No.* 3677.)

3680. Copper Moulds from Plaster. Many electro-metallurgists prefer taking a mould in copper when the medal is of plaster of Paris. This is done by the electrotype process (*see No.* 3671); the plaster model is saturated with wax over a slow fire, as already detailed, and then prepared for taking an electrotype in the usual manner (*See No.* 3672, *&c.*) We need hardly mention that the model in this case is destroyed; but, notwithstanding, in the case of plaster models, to take a copper mould is the most preferable, as it may be repaired in case of slight defect, and it may be used over and over again without deterioration. When an electrotype is required of a model that is undercut, or of a bust or figure, the process which we have described will not answer, as the mould cannot separate from the model. In such circumstances the general method of proceeding is to part the mould in separate pieces, and then join these together. The material used for this purpose is plaster of Paris. The operation, however, to be well done, requires a person of considerable experience.

3681. To Take Moulds in Gutta-Percha. Gutta-percha, as a material for moulding, serves the purpose most admirably. The method adopted for taking moulds is to heat the gutta-percha in boiling water, or in a chamber heated to the temperature of boiling water, which makes it soft and pliable. The medal is fitted with a metallic rim, or placed in the bottom of a metal saucer with a cylindrical rim a little larger than the medal; the medal being placed back down, a quantity of gutta-percha is pressed into the saucer, and as much added as will cause it to stand above the edge of the rim. It is now placed in a common copying-press and kept under pressure until it is quite cold and hard. The impressions taken this way are generally very fine. When the medal is not deep cut a less pressure may suffice, but when the pressure is too little the impression will be blunt. Gutta-percha takes a coating of black lead readily, and the deposit goes over it easily. A mixture of gutta-percha and marine glue has been recommended for moulds as superior to gutta-percha alone. This method of moulding by pressure is adopted, in principle, by printers, for making electrotype plates from type and engravings, employing sheets of prepared wax, at a temperature which gives it the proper consistency.

3682. To Mould the Face of a Person in Wax. Take 1 pound new wax, ⅛ pound resin, melt them at a slow fire, let them cool till you can endure some of it on your hand without burning it; then, having oiled the face with olive oil, and covered the hair of the eye-lids and eye-brows with paste, with a brush nimbly cover the face about the thickness of a quarter of a dollar, being careful not to stop the nostrils, and that the person does not close his eyes firmly enough to wrinkle his face, because that will render the face deformed. Take the wax off gently, and strengthen it with clay on the back, that it may not give way. After this manner you may cast all sorts of faces; laughing, weeping, or wry faces; also fruits or anything else, dividing the mould into two pieces with a warm knife; then fortify them with clay and join them together.

3683. To Mould Figures in Paste. Take the crumbs of a new drawn white loaf, mould it until it becomes as close as wax, and very pliable; beat it, and roll it with a rolling-pin, as fine and as far as it will go; then apply it to the figure to be moulded; dry it in a stove, and it will be very hard; and to preserve it from vermin, you may mix a little powder of aloes with it.

3684. Composition for Taking Moulds of Medals, &c. Melt together equal parts of spermaceti, stearine or hard tallow, and white wax. Or: Mix together by melting, ¾ pound black resin, ½ pound hard tallow, and 6 ounces bees' wax. This last is more adapted for coarse work, such as architectural ornaments, &c., and is poured on the object to be copied (previously oiled) in a melted state. Articles in plaster of Paris must be first soaked in water, observing that none remains on the surface so as to interfere with the design.

3685. To Make and Use Elastic Moulding. The process patented by Mr. Parks for taking a mould of any kind of model in one piece, is excellently adapted for the electrotypist. The material is composed of glue and molasses. 12 pounds glue are steeped for several hours in as much water as will moisten it thoroughly; this is put into a metallic vessel, which is placed in a hot bath of boiling water. When the glue falls into a fluid state, 3 pounds of molasses are added, and the whole is well mixed by stirring. Suppose, now, that the mould of a small bust is wanted, a cylindrical vessel is chosen so deep that the bust may stand in it an inch or so under the edge. The inside of this vessel is oiled, a piece of stout paper is pasted on the bottom of the bust to prevent the fluid mixture from going inside, and if it is composed of plaster, sand is put inside to prevent it from floating. It is next completely drenched in oil and placed upright in the vessel. This done, the melted mixture of glue and molasses is poured in till the bust is submerged to the depth of an inch. The whole must stand for at least 24 hours, till it is perfectly cool throughout—after which it is taken out by inverting the vessel upon a table, when, of course, the bottom of the bust is presented bare. The mould is now cut by means of a sharp knife, from the bottom up the back of the bust to the front of the head. It is next held open by the operator, when an assistant lifts out the bust and the mould is allowed to re-close. A piece of brown paper is tied round it to keep it firm. The operator has now a complete mould of the bust in one piece; but he cannot treat it like wax moulds, as its substance is soluble in water, and would be destroyed if put into the solution. A mixture of wax and resin, with occasionally a little suet, is melted and allowed to stand till it is on the point of setting, when it is poured carefully into the mould and left to cool. The mould is then untied and opened up as before; the wax bust is taken out, and the mould may be tied up for other casts. Besides wax and resin, there are several other mixtures used—deer's fat is preferable to common suet, stearine, etc. The object is to get a mixture that takes a good cast and becomes solid at a heat less than that which would melt the mould.

3686. To Take Moulds of Figures. If the model or figure be composed of plaster of Paris, a mould is often taken in copper by deposition. The figure is saturated with wax (*see No.* 3688), and copper deposited upon it sufficiently thick to bear handling without damage when taken from the model. The figure with the copper deposit is carefully sawn in two, and then boiled in water, by which the plaster is softened and easily separated from the copper, which now serves as the mould in which the deposit is to be made. It is prepared in the same way as we have described for depositing in copper moulds. (*See No.* 3672.) When the deposit is made sufficiently thick, the copper mould is peeled off, and the two halves of the figure soldered together. The copper moulds which are deposited upon the wax models taken in the elastic moulding are often treated in the same manner; but more generally these moulds are used for depositing silver or gold into them, to obtain fac-similes of the object in these metals, in which case the copper moulds are dissolved off by acids.

3687. To Coat Figures with Copper. When plaster busts or figures are wanted in copper, the usual way is to prepare the figure with wax (*see No.* 3688) and to coat it over with a thin deposit of copper, letting the copper remain. Some operators, when it can be done, remove the plaster and wash over the inside with an alloy of tin and lead melted. In this case the copper must previously be cleaned by washing first in a solution of potash, and then with chloride of zinc. The latter mode will cause the alloy to adhere to the copper and give it strength. In either of these cases the deposit must not be very thick, or it will throw the figures out of proportion, such as the features of a bust, etc. Any slight roughness of deposit may be easily smoothed down by means of fine emery or glass paper. (*See No.* 1935.)

3688. To Prepare a Plaster Cast for Electrotyping. First dry the plaster cast in the oven thoroughly, then get equal parts of bees' wax and common resin, melt them together, and boil the cast until it will not absorb any more; when cold, get some good black lead and cover the cast entirely, not thick, but a bright surface. (*See No.* 3689.)

3689. To Prepare Non-Metallic Moulds to Receive Deposit. Were any of the plaster or wax moulds, described above, attached to the zinc and immersed in the copper solution in the same manner as described in No. 3669, no deposit would be obtained, because neither the plaster nor the wax is a conductor of electricity. Some substance must now be applied to the surface in order to give it conducting power. There are several ways of communicating this property, but the best and most simple for the articles under consideration is to apply common black lead (carburet of iron) in the following manner: A copper wire is put round the edge of the medal, or, if wax moulds are used, a thin slip of copper may be inserted into the edge of the mould—or, being slightly heated and laid upon the back, the two will adhere. A fine brush is now taken (a small hat brush is very suitable) and dipped into fine black lead, and brushed over the surface of the metal. The brushing is to be continued until all the face round to the wire upon the edge, or slip of copper forming connection, has a complete metallic lustre. A bright polish is necessary to obtain a quick and good deposit. In brushing on the black lead, care should be taken not to allow any to go upon the back or beyond the copper connection, or the deposit will follow it, and so cause a loss of copper, and make the mould more difficult to separate from the deposit; being, as it were, incased. When the face of the mould is properly black-leaded, the copper wire connected with it is attached to the zinc plate in the porous cell, and the mould immersed in the copper solution; the deposit will immediately begin upon the copper connection, and will soon spread over every part, completely covering the black-lead surface. When the deposit is considered sufficiently thick for removing—which, in ordinary circumstances, will require from 1 to 3 days—the medal is taken out of the solution, and washed in cold water, and the connection is taken off. If the deposit has not gone far over the edge of the mould, the two may be separated by a gentle pull; if otherwise, the superfluous deposit must be eased off, and if care be taken the wax may be fit to use over again; but when the mould is plaster of Paris, however well it may be saturated with wax, it is seldom in a condition to use again. If the plaster mould be large and thick, it is advisable to coat the back with wax or tallow, which is done by brushing it over with either substance in a melted state; the mould, being cold, will not absorb the wax or tallow; hence it may be recovered again. The sulphate of copper possesses so penetrating a quality that if the slightest imperfection occurs in the saturation of the mould by wax, the solution will penetrate through it, and the copper will be deposited upon the face of the object adhering to the plaster, giving to the metal a rough, matted appearance, and seriously injuring it.

3690. To Use Metal Moulds. The mould in fusible alloy does not require to be black-leaded, but the surface to be electrotyped must be prepared with turpentine, &c., (*see No.* 3673), and the back and edge must be protected by a coating of wax or other non-conducting material; it may be connected with the zinc pole by putting a wire round its edge previous to laying on the non-conducting substance, such as tallow or wax, which should also cover the wire. Or a slip of copper or wire may be laid upon the back, and fastened by a drop or two of sealing-wax; the back is then coated, but care must be taken that the wax does not get between the connection and the medal, which will prevent deposit. The deposit on this mould goes on instantaneously. When sufficiently thick, it may be taken off in the same manner as from the wax mould. These moulds may be used several times, if care be taken not to heat them, as they easily melt. The medals obtained from metallic moulds prepared with the turpentine solution have a bright surface, which is not liable to change easily, but if the mould has been prepared with oil or composed of wax or plaster, the metal will either be dark, or will very easily tarnish. For the means of preserving them by bronzing *see Nos.* 3771, *&c.*

3691. Precautions on Putting the Moulds into a Solution. In putting moulds into the copper solution, the operator is often annoyed by small globules of air adhering to the surface, which either prevent the deposit taking place upon these parts, or, when they are very minute, permit the deposit to grow over them—causing small hollows in the mould, which give a very ugly appearance to the face of the medal. To obviate this, give the mould, when newly put into the solution, two or three shakes, or give the wire attached to it, while the mould is in the solution, a smart tap with a key or knife, or anything convenient; but the most certain means we have tried, is to moisten the surface with alcohol just previous to putting it into the copper solution. A little practice in these manipulations will soon enable the operator to avoid these annoyances.

3692. Electrotyping on Large Objects. When busts or figures, whether of wax or plaster of Paris, are to be coated with copper, with no other conducting surface than black-lead, it is attended with considerable difficulty to the inexperienced electrotyper. The deposit grows over all the prominent parts, leaving hollow places, such as armpits, neck, etc., without any deposit; and when once missed, it requires considerable management to get these parts coated, as the coated parts give a sufficient passage for the current of electricity. It is recommended by some electrotypists to take out the bust, and coat the parts deposited upon the wax, to prevent any further deposit on them; but this practice is not good, especially with plaster of Paris, for an electrotype ought never to be taken out till finished. Sometimes the resistance of the hollow parts is occasioned by the solution becoming exhausted from its position in regard to the positive pole. In this case a change of position effects a remedy. It may be remarked that when a bust or any large surface having hollow parts upon it, is to be electrotyped, as many copper connections as possible ought to be made between these parts and the zinc of the battery. Let the connections with the hollow parts be made with the finest wire which can be had, and let the zinc plate in the cell have a large surface compared to the surface of the figure, and the battery be of considerable intensity; if attention is paid to these conditions, the most intricate figures and busts may be covered over in a few hours. Care has to be observed in taking off the connections from the deposit, or the operator may tear off a portion of the deposit; if the wires used are fine, they should be cut off close to the deposited surface.

3693. To Coat Busts and Figures. Busts and figures, and other complicated works of art, which cannot be perfectly coated with black-lead, may be covered by a film of silver or gold, which serves as a conducting medium to the copper. This is effected by a solution of phosphorus in sulphuret of carbon. The solution of phosphorus is prepared by adding to each pound of that substance 15 pounds bisulphuret of carbon, and then thoroughly agitating the mixture; this solution is applicable to various uses, and, amongst others, to obtaining deposits of metal upon non-metallic substances, either by combining it with the substances on which it is to be deposited, as in the case of wax, or by coating the surface thereof. Any of the known preparations of wax may be treated in this way, but the one preferred is composed of from 6 to 8 ounces of the solution, 5 pounds wax, and 5 pounds deer's fat, melted together at a low heat, on account of the inflammable nature of the phosphorus. The composition thus obtained is acted upon by an electrotyping solution as readily as if it were coated with the black-lead.

3694. To Gild or Silver-Plate Flowers, &c. If the solution of phosphorus (*see No.* 3693) is to be applied to the surface of the article, an addition is made to it of 1 pound wax or tallow, 1 pint spirits of turpentine, and 2 ounces pure India-rubber (dissolved with 1 pound asphalt, in bisulphuret of carbon), for every pound phosphorus contained in the solution. The wax and tallow being first melted, the solution of India-rubber and asphalt is stirred in; then the turpentine, and after that the solution of phosphorus is added. The solution prepared in this manner is applied to the surfaces of non-metallic substances, such as wood, flowers, etc., by immersion or brushing; the article is then immersed in a dilute solution of nitrate of silver or chloride of gold; in a few minutes the surface is covered with a fine film of metal, sufficient to ensure a deposit of any required thickness on the article being connected with any of the electrical apparatus at present employed for coating articles with metal. The solution intended to be used is prepared by dissolving 4 ounces silver in nitric acid, and afterwards diluting the same with 12 gallons water; the gold solution is formed by dissolving 1 ounce gold in nitro-muriatic acid (aqua regia), and then diluting it with 10 gallons water. The solutions of silver and gold, prepared as above, will last for a long time, and serve for a great many articles. When it is convenient it is best to use both solutions. The connecting wire should first be attached to the article to be coated, before being dipped into the phosphorus solution, but connected at such parts as will not hurt the appearance of the object by leaving a mark when it is taken off. Care should be taken not to touch the article with the hands after it is dipped into the solution. The object supported by the connections is immersed in the phosphorus solution, where it remains for two or three minutes. When taken out it is dipped into the silver solution, and, as soon as the surface becomes black, having the appearance of a piece of black china, it is to be dipped several times in distilled water, and then immersed in the solution of gold about three minutes; the surface takes a bronze tinge by the reduction of the gold. It is next washed in distilled water by merely dipping, not by throwing water upon it. The wire connection is now attached to the zinc of the battery, and then the article put into the copper solution, and in a few minutes the article is coated over with a deposit of copper. A thin copper surface may thus be given to small busts or figures without sensibly distorting the features.

3695. Electrotyping on Wood. Dip the wood in melted wax, then brush over with black-lead until polished; insert a wire of copper, and see that it is also covered with the plumbago, and in contact with that already on the wood; now attach to the pole of the battery, and immerse in the solution of sulphate of copper. The battery should not be too strong.

Electroplating.

The foregoing matter refers to electrotyping, that is, copper-coating, by galvanism. Electroplating, or coating with silver, is conducted in a similar manner to electrotyping as far as general principles and manipulation are concerned, but differs in the solutions used, as well as in the preparation of the objects to be electroplated.

3697. To Prepare Cyanide of Silver. First dissolve 1 ounce pure silver in 2 ounces nitric acid and 2 ounces hot water, after which further dilute with 1 quart hot water. The propriety of diluting the nitrate of silver before precipitating by the cyanide of potassium arises from the fact that the salts of potash and soda (such as the nitrates, chlorides, and sulphates), when in strong solution, dissolve small quantities of the silver salt, and thus cause a loss, which is prevented by previous dilution with water. The nitric acid used must be free from hydrochloric (muriatic) acid; to a small quantity of the acid add a few drops of solution of nitrate of silver;

if it gives a milky white precipitate, it contains muriatic acid, and should be rejected. Then dissolve 5 ounces cyanide of potassium in 1 quart water. Add this by degrees to the silver solution until the whole of the silver is precipitated, which may be tested thus: Stir the mixture and allow it to settle; then drop into the clear liquid a very small quantity of the second preparation, from the end of a glass rod; if the clear liquid is rendered turbid, it is a proof that the whole of the silver is not separated; but if the liquid remains unchanged, it shows that the silver is entirely separated. The clear liquid is then to be poured off, and the precipitate, which is cyanide of silver, washed at least 4 times in hot water, dried and bottled for use. The use and handling of cyanide of potassium requires great caution, as 11 grains of it are sufficient to kill a grown person. The fumes thrown off while dissolving the silver in nitric acid are also highly deleterious, and must not be inhaled; it is better, therefore, not to dissolve silver in a close room.

3698. To Make Silver Solution. The solution of silver used for plating consists of cyanide of silver dissolved in potassium, adding a solution of cyanide of potassium to the cyanide of silver until it is all dissolved. The resulting solution constitutes the cyanide of potassium and silver, and forms the plating solution. It ought to be filtered previous to using, as there is always formed a black sediment, composed of iron, silver, and cyanogen, which, if left in the solution, would fall upon the surface of the article receiving the deposit, and make it rough. The sediment, however, must not be thrown away, as it contains silver. The cyanide of potassium, used to dissolve the cyanide of silver, may be so diluted that the plating solution, when formed, shall contain 1 ounce of silver in the gallon; of course the proportion of silver may be larger or smaller, but that given is best for plating. In dissolving 100 ounces of silver, the following proportions of each ingredient are those which have been found in practice to be the best. Take 7 pounds of the best nitric acid, and 61 ounces of cyanide of potassium, of the average quality; this quantity will precipitate the 100 ounces of silver dissolved in the acid solution. After this is washed, take 62 ounces more of cyanide of potassium, the solution of which will dissolve the precipitate; this being done, the plating solution is then formed. Of course these proportions will vary according to the difference in the quality of the materials; but they will serve to give an idea of the cost of the silver solution prepared in this manner.

3699. To Dissolve Cyanide of Silver in Yellow Prussiate of Potash. Dissolve the cyanide of silver by yellow prussiate of potash (ferrocyanide of potassium), 3 pounds of which are required to dissolve 1 ounce of silver. This forms an excellent plating solution, and yields a beautiful surface of silver. It must have a weak battery power, and consequently the silver is very soft. The positive electrode does not dissolve in this solution; there is formed upon its surface a white scaly crust, which drops off and falls to the bottom; and the solution soon becomes exhausted of silver, and will need to be renewed.

3700. Solution Made with Oxide of Silver. A good silver solution for electroplating white metal and brass is made by dissolving 1 part oxide of silver in 8 parts cyanide of potassium and 64 parts warm water. Oxide of silver is made by precipitating a solution of the nitrate by a dissolved alkali like potassa or baryta.

3701. To Make Silver Solution by the Battery. The best and cheapest method of making up the silver solution is by the battery, which saves all expense of acids and the labor of precipitation. To prepare a silver solution which is intended to have an ounce of silver to the gallon, dissolve 123 ounces cyanide of potassium in 100 gallons water; get one or two flat porous vessels, submerge them in this solution to within half an inch of the rim, and fill them to the same height with the solution; in these porous vessels place small plates or sheets of iron or copper, and connect them with the zinc pole of a battery; in the solution outside the shallow vessels place a sheet or sheets of silver connected with the *silver pole* of the battery. This arrangement being made at night, and the power employed being a Smee's battery of 6 cells, the zincs 7 inches square, it will be found in the morning that there will be dissolved 60 to 80 ounces of silver from the sheets. The solution is now ready for use; and by observing that the articles to be plated have less surface than the silver plate forming the positive electrode, for the first two days, the solution will then have the proper quantity of silver in it. Occasionally a little silver is found in the porous cell; it is therefore not advisable to throw away the solution in them without first testing it for silver, which is done by adding a little muriatic acid to it. The amateur electrotypist may, from this description, make up a small quantity of solution for silvering his medals or figures. For example, a half-ounce of silver to the gallon of solution will do very well; a small quantity may be prepared in little more than an hour. As the cyanide of potassium dissolves silver without the aid of a battery, a plating liquor may be formed by merely allowing a piece of silver to steep in this solution for a few days; but this is tedious and uncertain, although for small operations, and where porous vessels are not convenient, it will serve the purpose.

3702. To Recover Silver from Solution. When a silver solution gets out of order, and cannot be rendered fit for use again, the silver may be recovered by adding to the solution any acid that will neutralize the alkali; if nitric or sulphuric acid be used, the silver precipitates as cyanide, but if hydrochloric acid be used, the silver will be precipitated as a chloride; in either case the solution should be diluted, or a portion of the precipitate will be redissolved. The precipitate is allowed to deposit, the clear liquor decanted, and the vessel filled with water to wash the precipitate, which is afterwards collected upon a filter and dried, and then mixed with twice its weight of carbonate of potash, and fused in a Hessian crucible for 15 minutes, or until the fused fluid ceases to effervesce. On removing the crucible, and pouring the whole into an iron ladle, when cool the silver will be found in the metallic state at the bottom of the ladle. In these operations, when pouring the acid into the cyanide solution, great care must be taken not to inhale the fumes given off, which are very abundant and poisonous. The operation should be done in the open air, and even then it is bad. Instead of throwing down the silver by an acid, it is better to evaporate the solution to dryness, and to fuse the product as described; in which case the cyanide is an excellent reducing flux, requiring no addition of carbonate of potash, and saves the necessity of evolving poisonous fumes.

3703. Test for Free Cyanide of Potassium in Solutions. If we dissolve a small quantity of sulphate of copper and add to it an excess of ammonia, there is produced a deep blue color. Cyanide of potassium will destroy the blue color, in a fixed chemical proportion. To obtain this proportion, take ten grains of pure cyanide of potassium and dissolve in water; then take a certain quantity, say 100 grains, of sulphate of copper, and convert it into ammoniuret, the whole measuring a given quantity, and pour from an alkalimeter this blue liquor into the cyanide of potassium till it ceases to destroy the color, then mark the number of graduations required, and that amount of copper solution will represent 10 grains cyanide of potassium—a quantitative test will thus be got for the full cyanide of potassium in the solution, and should be used as follows: Say that the color of 60 graduations of the blue solution was destroyed by the 10 grains of cyanide of potassium; then, to test the quantity of free cyanide of potassium in the plating solution, take 60 graduations of the blue liquor in any convenient vessel, and add to it from an alkalimeter the plating solution, till the color of the blue liquor is destroyed, then note the quantity which contains 10 grains free cyanide, from which the quantity in the whole solution may be calculated.

3704. Test for the Quantity of Free Cyanide of Potassium in Solutions. It has been already mentioned that the cyanide of silver, as it forms upon the surface of the silver plate, is dissolved by the cyanide of potassium. This renders it necessary to have always in the solution free cyanide of potassium. Were we to use the pure crystalline salt of cyanide of potassium and silver, dissolved in water, without any free cyanide of potassium, we should not obtain a deposit beyond a momentary blush, as the silver plate or electrode would get an instantaneous coating of cyanide of silver, and this not being dissolved, the current would stop. The quantity of free cyanide of potassium required in the solution varies according to the amount of silver that is present, and the rapidity of the deposition. If there be too little of it, the deposit will go on slowly; if there be too much, the silver plate will be dissolved in greater proportion than the quantity deposited, and the solution will consequently get stronger. The proportion we have found best is about half by weight of free cyanide of potassium to the quantity of silver in solution; thus, if the solution contains 2 ounces of silver to the gallon, it should have 1 ounce of free cyanide of potassium per gallon. This is known by taking some nitrate of silver, dissolving it in distilled water and placing it in a common alkalimeter (*see No.* 82), graduated into 100 parts. The proportion of the nitrate of silver in the solution is to be such that every two graduations of the solution should contain 1 grain. A given quantity of the plating solution is now taken—say 1 ounce by measure, and the test solution of nitrate of silver is added to it by degrees, so long as the precipitate formed is redissolved. When this ceases the number of graduations is then noted, and the following equation gives the quantity of free cyanide. Every 175 nitrate of silver are equal to 130 cyanide of potassium in solution. Suppose 20 graduations were taken, equal to 10 grains nitrate of silver, then 175 : 130 :: 10 : 7.4 grains free cyanide of potassium. This, multiplied by 160, the number of fluid ounces per gallon, will make about 2½ ounces. We have taken 2 graduations to 1 grain of nitrate of silver, that the solution may be considerably dilute and less liable to error. The following table is calculated at a half grain nitrate of silver to the graduation, and will be a guide to the student or workman. The quantity of solution tested is 1 ounce by measure.

Number of graduations used.	Free cyanide per gallon.		
	oz.	dwt.	gr.
1	0	2	13
2	0	5	3
3	0	7	16
4	0	10	6
5	0	12	19
6	0	15	9
7	0	17	22
8	1	0	13
9	1	3	1
10	1	5	12
11	1	8	5
12	1	10	19
13	1	13	8
14	1	15	22
15	1	18	11
16	2	1	2
17	2	3	14
18	2	6	2
19	2	8	11
20	2	11	0

3705. To Cleanse Articles for Electroplating. Articles that are to be plated are first boiled in an alkaline lye, to free them from grease, then washed from the lye, and dipped into dilute nitric acid, which removes any oxide that may be formed upon the surface; they are afterwards brushed over with a hard brush and fine sand. (*See No.* 3381.) The alkaline lye should be in a caustic state, which is easily effected by boiling the carbonated alkali with slacked lime, until, on the addition of a little acid to a small drop of the solution, no effervescence occurs. (*See No.* 101.) The lime is then allowed to settle, and the clear liquor is fit for use. The lye should have about ½ pound soda-ash, or pearl-ash, to the gallon of water. The nitric acid, into which the article is dipped, may be diluted to such an extent that it will merely act upon the metal. Any old acid will do for this purpose. In large factories the acid used for dipping before plating is generally afterwards employed for the above purpose of cleaning.

3706. To Prepare Articles for the Decomposing Cell. The article being thoroughly cleaned and dried, has a copper wire attached to it, either by twisting it round the article or putting it through any open part of it, to maintain it in suspension. It is then dipped into nitric acid as quickly as possible, and washed through water, and then immersed in the decomposing cell containing silver solution, suspending it by the wire which connects with the zinc pole of the battery. The nitric acid generally used and found best for dipping has a specific gravity 1.518, and contains 10 per cent. sulphuric acid. The article is instantaneously coated with silver, and ought to be taken out after a few seconds and well brushed. On a large scale, brushes of brass wire attached to a lathe are used for this purpose; but a hard hair brush with a little fine sand will do for small work. This brushing is used in case any particle of foreign matter may be still on the surface. It is then replaced in the solution, and in the course of a few hours a coating of the thickness of tissue paper is deposited on it, having the beautiful matted appearance of dead silver. Any thickness of silver may be given to a plate by continuing the operation a proper length of time. 1¼ to 1½ ounces of silver to the square foot of surface will give an excellent plate about the thickness of ordinary writing paper. We may remark that, in depositing silver from the solution, a weak battery may be used; though when the battery is weak the silver deposited is soft, but if used as strong as the solution will allow, the silver will be equal in hardness to rolled or hammered silver. If the battery is stronger than the solution will stand, or the article very small compared to the size of the plate of silver forming the positive electrode, the silver will be deposited as a powder. Gas should never be seen escaping from either pole; and the surface of the article should always correspond as nearly as possible with that of the positive electrode, otherwise the deposit runs the risk of not being good; it requires more care, and the solution is apt to be altered in strength, because if the positive electrode be large compared with the negative, the solution will become stronger in silver, while if smaller in proportion the solution will become exhausted of silver.

3707. To Silver-plate Large Articles (such as those plated in factories), it is not always sufficient to dip them in nitric acid; wash and immerse them in the solution, in order to effect a perfect adhesion of the two metals. To secure this, a small portion of quicksilver is dissolved in nitric acid, and a little of .this solution is added to water, in sufficient quantity to enable it to give a white silvery tint to a piece of copper when dipped into it; the article then, whether made of copper, brass, or German silver, after being dipped in the nitric acid and washed, is dipped into the nitrate of mercury solution till the surface is white; it is then well washed by plunging it into two separate vessels containing clean water, and finally put into the plating solution. This secures perfect adhesion of the metals. One ounce of quicksilver thus dissolved will do for a long time, though the liquor is used every day. When the mercury in this solution is exhausted, it is liable to turn the article black upon being dipped into it; this must be avoided, as in that case it also causes the deposited metal to strip off.

3708. To Preserve the Dead, Matted Appearance of Silver after Electroplating. If it is desired to preserve the surface in this condition, the article must be taken out of the electroplating solution, care being taken not to touch it by the hand, and immersed in boiling distilled water for a few minutes. On being withdrawn, sufficient heat has been imparted to the metal to dry it instantly. If it is a medal, it ought to be put in an air-tight frame immediately, or if a figure, it may be at once placed under a glass shade, as a very few days' exposure to the air tarnishes it, by the formation of sulphuret of silver, especially in a room where there is fire or gas.

3709. To Remove the Chalky Appearance of Silver after Plating. When articles are taken out of the electroplating solution they are swilled in water, and then put into boiling water. They are afterwards put into hot sawdust, which dries them perfectly. Their color is chalk-white. They are generally weighed before being scratch-brushed; that is, brushed with fine wire brushes (*see Nos.* 3381 *and* 3706), and old ale, beer, or water containing in solution a little gum, glue, or sugar, but the amateur may use a hard hair brush. It may be afterwards burnished according to the usual method of burnishing, by rubbing the surface with considerable pressure with polished steel or the mineral termed bloodstone. Although this operation does not displace any of the silver, still, in taking off the chalky appearance, there is a slight loss of weight. The appearance after scratching is that of bright metallic silver.

3710. To Increase the Brightness of the Deposit. A little sulphuret of carbon added to the plating solution prevents the chalky appearance, and gives the deposit the appearance of metallic silver; the reaction which takes place in this mixture is not yet understood. The best method of applying the sulphuret of carbon is to put one or two ounces into a large bottle, then fill it with strong silver solution having an excess of cyanide of potassium, and let it repose for several days, shaking it occasionally. A little of this silver solution is added, as required, to this plating solution, which will give the articles plated the same appearance as if scratched. It is also found that the presence of sulphuret of carbon prevents the solution from going out of order; indeed, we have seen a solution that has been constantly working from two to three years, while, generally, they were subject to go out of order for a time, in less than one year—although, after standing a time, they would recover—but these are curious reactions not yet investigated.

3711. To Insure Success in the Electroplating Process. In order to insure success in silver-plating upon metals and metallic alloys, two solutions of silver are requisite; the first, to whiten or fix the silver to such metals as iron, steel, britannia metal, and German silver; the second, to finish the work, as any amount of pure silver can be deposited from the second solution.

3712. First, or Whitening Solution. Dissolve 2½ troy pounds cyanide of potassium, 8 ounces carbonate of soda, and 5 ounces cyanide of silver in 1 gallon rain or distilled water. This solution should be used with a compound battery of 3 to 10 pairs, according to the size of the work to be plated. The use of this solution will insure the adhesion of silver to all kinds of brass, bronze, type metal, &c., without employing mercury, the frequent use of which is injurious to the health of the operator.

3713. Second, or Finishing Solution. Dissolve 4½ troy ounces cyanide of potassium, and 1½ ounces cyanide of silver, in 1 gallon rain or distilled water. This solution should be used with one large cell of Smee's battery, observing that the silver plate is placed as near the surface of the articles to be plated as possible.

3714. Boettger's Test for the Silver on Silver-Plated Metals. The test fluid consists of a saturated solution of bichromate of potassa in nitric acid, specific gravity 1.2. Any dirt or varnish having been removed by strong alcohol from the metallic surface to be tested, a drop of the test fluid is applied to it by means of a glass rod, and immediately afterwards washed off with some cold water. If pure silver is present (as regards silver coins, these are left in contact with the test fluid for a greater length of time), there will appear clearly a blood-red colored mark (chromate of silver). Upon German silver the test liquid appears brown, but after washing with water the blood-red colored mark does not appear; the so-called britannia-metal is colored black; on platinum no action is visible; metallic surfaces coated with an amalgam of mercury yield a reddish speck, which, however, is entirely washed off by water; on lead and bismuth the test liquid forms a yellow-colored precipitate; zinc and tin are both strongly acted upon by this test liquid, which, as regards the former metal, is entirely removed by water, while, as regards the latter, the test liquid is colored brownish, and addition of water produces a yellow precipitate which somewhat adheres to the tin.

3715. Plating on Iron or Steel. Take 2 quarts rain water, dissolve 2 pounds cyanide of potassium, and filter. In order to plate steel or iron, dip it into pure sulphuric acid for one minute, then clean with pumice stone, and brush; rinse, and hang in solution of cyanide of potassium for three minutes, or until it becomes white; then hang in silver solution until plated heavy enough. (*See No.* 3698.)

3716. Taking Silver from Copper, Etc. First by stripping or dissolving it off; this is done by putting into a stoneware or copper pan some strong sulphuric acid (vitriol), to which a little nitrate of potassa is added; the article is laid into this solution, which will dissolve the silver without materially affecting the copper; nitrate of potassa is added by degrees, as occasion requires; and if the action is slow a little heat is applied to the vessel. The silver being removed, the article is well washed and then passed through the potash solution, and finished for plating. When the sulphuric acid becomes saturated with silver it is diluted, and the silver is precipitated by a solution of common salt; the chloride of silver formed is collected and fused in a crucible with carbonate of potash, when the silver is obtained in a metallic state, as a knob or button. The crucible should not be over two-thirds full, and should be kept in fusion till effervescence ceases. The crucible is then removed from the fire, and, when cool, it is broken. (*See No.* 3702.) The article thus stripped by acids often shows a little roughness, not from the effects of the acid, but because the copper under the silver has not been polished; it is therefore a necessary practice in the electroplating factories to polish the articles before plating. This is done by means of a circular brush, more or less hard as required, fixed upon a lathe, and a thin paste made of oil and pumice-stone ground as fine as flour. By this process the surface of any article can be smoothed and polished; but a little experience is required to ensure success, and enable the operator to polish the surface equally without leaving brush marks. After this the article must be cleaned in potash before it is plated.

3717. To Recover Silver from Copper. Instead of stripping off the silver by means of acid, as in No. 3716, it is a more common and preferable mode to brush off the silver by the operation just described. In this case the brushings must be collected, dried, and burned; this may be done in an iron pan, keeping it at a red heat until all carbonaceous matters are consumed; the remainder is fused with carbonate of soda or potash, when the silver is obtained, in combination with a little copper.

3718. Cyanide of Silver and Potassium, its Decomposition During the Plating Process. The silver salt in the plating solution is a true double salt, being, as already described, a compound of 1 equivalent of cyanide of silver, and 1 of cyanide of potassium—two distinct salts. In the decomposition of the silver solution by the electric current, the former, cyanide of silver, is alone affected; the silver is deposited, and the cyanogen passes to the positive plate or electrode. The cyanide of potassium is therefore set at liberty upon the surface of the article receiving the silver deposit, and its solution, being specifically lighter than the general mass of the plating solution, rises to the top; this causes a current to take place along the face of the article being plated. If the article has a flat surface, suppose that of a waiter or tray, upon which a prominence exists, as a mounting round the edge, it will cause lines and ridges from the bottom to the top. Newly formed solutions are most subject to produce this annoyance.

3719. Dead Silvering for Medals. The perfect smoothness which a medal generally possesses on the surface, renders it very difficult to obtain a coating of dead silver upon it, having the beautiful silky lustre which characterizes that kind of work, except by giving it a very thick coating of silver, which takes away the sharpness of the impression. This dead appearance can be easily obtained by putting the medal, previous to silvering, in a solution of copper, and depositing upon it, by means of a weak current, a mere blush of copper, which gives the face of the medal that beautiful crystalline richness that deposited copper is known to give. The medal is then to be washed from the copper solution, and immediately to be put into the silver solution. A very slight coating of silver will suffice to give the dead frosty lustre so much admired, and in general so difficult to obtain.

3720. To Recover Silver from Old Plated Goods. Oil of vitriol, together with 5 per cent. of nitrate of soda, is heated in a cast-iron boiler, or a stoneware pan, to 212° Fahr. The silver-plated clippings are placed in a sheet-iron bucket or cullender, which is fastened to a pulley that it may be moved about in the acid. As soon as the silver is removed, the cullender is raised, allowed to drain, then immersed in cold water and emptied, to be again used in the same manner. When the acid bath is fresh, the desilvering proceeds very rapidly, and even with heavy plated ware takes but a few minutes; with the gradual saturation of the bath more time is required, and it is readily perceived when the acid must be renewed. The small amount of acid solution adhering to the copper, precipitates its silver when brought into the water. To obtain its complete removal, the clippings, when raised from the desilvering bath, and before immersion in water, may be dipped into a second bath prepared in the same manner, which is afterwards to be used in place of the first. The saturated bath, on cooling, congeals to a crystalline semi-fluid mass of sulphate of copper and of soda. The silver is removed by chloride of sodium (common salt) which is added in small portions at a time, while the solution is yet warm. The chloride of silver separates readily, and is washed and reduced in the usual manner. The acid solution contains but a very small portion of copper, hardly enough to pay for recovering.

3721. To Recover Silver from Copper. This process is applied to recover the silver from the plated metal, which has been rolled down for buttons, toys, etc., without destroying any large portion of the copper. For this purpose, a dissolving solution is composed of 3 pounds oil of vitriol, 1½ ounces nitre, and 1 pound water. The plated metal is boiled in it till the silver is dissolved, and then the silver is recovered by throwing common salt into the solution. (*See No.* 3214.)

3722. Test Fluid for Silver-Plated Goods. For this purpose a testing fluid is prepared by adding pure nitric acid to powdered red chromate of potash, and mixing them in such a manner that a part of the latter remains in suspension, the whole being kept well stirred during the mixing. Equal parts by weight of each may be taken. The nitric must be quite free from hydrochloric acid, and have the proper degree of concentration, being neither too fuming nor too dilute; it should have a specific gravity between 1.20 and 1.25. When the mixture has been prepared for a few hours, and been stirred several times, the reddish-colored liquid is poured off from the residue and kept in a stoppered bottle.

3723. To Test Silver-Plated Goods. The ordinary and very accurate method of testing of silver is founded upon the insolubility of chloride of silver in dilute acids and in water. This otherwise satisfactory test is, however, difficult to carry out when an article is very thinly plated. A drop of the test liquid (see last receipt) is then brought in contact with the metal to be tested, and immediately washed off again with water. If a visible blood-red spot remains, silver is present. This method requires only the following precautions: The metallic surface must have been quite cleansed from grease or varnish with spirits of wine—water must be poured over the treated surface before judging of the color, as that of the testing fluid is altered by the metal, and the red precipitate is not distinctly visible until the colored liquid has been washed off. The red spot can afterwards be very easily removed with the finger. By this method the slightest trace of silver in an alloy may be ascertained. When an article is suspected to be only thinly plated, a very minute drop of the testing fluid should be used. With no other metal or alloy does this red spot, so characteristic of silver, appear; in some cases the testing fluid only corrodes the surface of the metal, whilst in others colored precipitates are formed, which, however, cannot be confounded with those of silver. German silver brought into contact with the testing fluid affords no red spot after being washed. The spot will, however, have been strongly corroded. Britannia metal yields a black spot; zinc is strongly corroded; platinum is not attacked; lead gives a yellow precipitate; tin is strongly affected by the fluid; when the brownish-colored testing fluid is washed off, a yellow precipitate is perceived, which adheres tightly to the metal; copper is strongly attacked, a tarnished surface of this metal is brightened by the action of the acid.

Electro-Gilding.

The operation of gilding, or covering other metals with a coating of gold by the battery, is performed in the same manner as electroplating, with the exception of a few practical modifications.

3725. To Prepare Chloride of Gold. Dissolve 1 part gold in 3 parts nitro-hydrochloric acid (aqua regia); evaporate until vapors of chlorine begin to be disengaged, then set the solution aside to crystallize. Aqua regia consists of 1 part nitric acid and 2 parts (both by measure) muriatic (hydrochloric) acid.

If aqua ammonia be added to a solution of gold in aqua regia, it precipitates a reddish-yellow deposit, which may be collected, washed, and dried. This is the ammoniuret of gold, and must be handled and prepared with great caution, it being the fulminate of gold.

3726. To Prepare a Solution of Gold. Add a solution of cyanide of potassium to a solution of chloride of gold (*see No.* 3725) until all the precipitate is redissolved; but this gives chloride of potassium in the solution, which is not good. In the preparation of the solution by this means there are some interesting reactions. As the chloride of gold has always an excess of acid, the addition of cyanide of potassium causes violent effervescence, and no precipitate of gold takes place until all the free acid is neutralized, which causes a considerable loss to the cyanide of potassium. There is always formed in this deposition a quantity of ammonia and carbonic acid, from the deposition of the cyanate of potash; and if the chloride of gold be recently prepared, and hot, there is often formed some aurate of ammonia (fulminate of gold), which precipitates with the cyanide of gold. Were this precipitate to be collected and dried, it would explode when slightly heated. By previously diluting the chloride of gold, or using it cold, this compound is not formed. After the free acid is neutralized by the potash, further addition of the cyanide of potassium precipitates the gold as cyanide of gold, having a light yellow color; but as this is slightly soluble in ammonia and some of the alkaline salts, it is not advisable to wash the precipitate, lest there be a loss of gold. Cyanide of potassium is generally added until the precipitate is redissolved; consequently much impurity is formed in the solution, namely, nitrate and carbonate of potash with chloride of potassium and ammonia. Notwithstanding, this solution works very well for a short time, and it is very good for operations on a small scale.

3727. To Prepare Cyanide of Gold. Dissolve 1 ounce of fine gold in 28 pennyweights nitric acid and 2 ounces muriatic acid, and add 1 quart hot water. Precipitate with the second preparation used for cyanide of silver (*see No.* 3697), and proceed in the same manner.

3728. To Prepare a Solution of Gold. Dissolve 4 troy ounces cyanide of potassium and 1 ounce cyanide of gold in 1 gallon rain or distilled water. This solution is to be used at about 90° Fahr., with a battery of at least two cells. Gold can be deposited, of various shades to suit the taste, by adding to the gold solution a small quantity of the cyanides of silver, copper, or zinc, and a few drops of hydrosulphuret of ammonia.

3729. To Prepare a Gold Solution by the Battery Process. To prepare a gallon of gold solution, dissolve 4 ounces cyanide of potassium in 1 gallon water, and heat the solution to 150° Fahr.; now take a small porous cell and fill it with this cyanide solution, and place it inside the gallon of solution; into this cell is put a small plate of iron or copper, and attached by a wire to the zinc pole of a battery. A piece of gold is placed into the large solution, facing the plate in the porous cell, and attached to the silver of the battery. The whole is allowed to remain in action until the gold, which is to be taken out from time to time and weighed, has lost the quantity required in solution. By this means a solution of any strength can be made, according to the time allowed. The solution in the porous cell, unless the action has continued long, will have no gold, and may be thrown away. Half an hour will suffice for a small quantity of solution—of course any quantity of solution may be made up by the same means. For all the operations of gilding by the cyanide solution, it must be heated to at least 130° Fahr. The articles to be gilt are cleaned in the way described for silver (*see No.* 3705), but are not dipped into nitric acid previous to being put into the gold solution. 3 or four minutes is sufficient time to gild any small article. After the articles are cleaned and dried they are weighed, and, when gilt, they are weighed again; thus the quantity of gold deposited is ascertained. Any convenient means may be adopted for heating the solution. The one generally adopted is to put a stoneware pan containing the solution into an iron or tinplate vessel filled with water, which is kept at the boiling point either by being placed upon a hot plate or over gas. The hotter the solution the less battery power is required. Generally a battery of 3 or 4 cells is used for gilding, and the solution is kept at 130° to 150° Fahr. But 1 cell will answer if the solu- is heated to 200°.

3730. Process of Electro-Gilding. The process of gilding is generally performed upon silver articles. The method of proceeding is as follows: When the articles are cleaned as described in No. 3705, they are weighed, and well scratched with wire brushes, which cleanse away any tarnish from the surface, and prevents the formation of air-bubbles. They are then kept in clean water until it is convenient to immerse them in the gold solution. One immersion is then given, which merely imparts a blush of gold; they are taken out and again brushed; they are then put back into the solution and kept there for 3 or 4 minutes, which will be sufficient if the solution and battery are in good condition; but the length of time necessarily depends on these two conditions, which must be studied and regulated by the operator.

3731. To Electro-Gild Iron, Tin, and Lead. Iron, tin, and lead are very difficult to gild direct; they therefore generally have a thin coating of copper deposited upon them by the cyanide of copper solution (*see Nos.* 3754 *and* 3755), and immediately put into the gilding solution.

3732. Conditions Required in Electro-Gilding. The gilding solution generally contains from one-half to an ounce of gold in the gallon, but for covering small articles, such as medals, for tinging daguerreotypes, gilding rings, thimbles, etc., a weaker solution will do. The solution should be sufficient in quantity to gild the articles at once, so that it should not have to be done bit by bit; for when there is a part in the solution and a part out, there will generally be a line mark at the point touching the surface of the solution. The rapidity with which metals are acted upon at the surface line of the solution is remarkable. If the positive electrode is not wholly immersed in the solution, it will, in a short time, be cut through at the surface of the water, as if cut by a knife. This is also the case in silver, copper, and other solutions.

3733. To Maintain the Strength of the Gold Solution. As the gold solution evaporates by being hot, distilled water must from time to time be added. The water should always be added when the operation of gilding is over, not when it is about to be commenced, or the solution will not give so satisfactory a result. When the gilding operation is continued successively for several days, the water should be added at night. To obtain a deposit of a good color, much depends upon the state of the solution and battery; it is therefore necessary that strict attention be paid to these, and the more so as the gold solution is very liable to change if the size of the article receiving the deposit is not the same as that of the positive electrode plate. The result of a series of observations and experiments, continued daily throughout a period of nine months, showed that in five instances only the deposit was exactly equal to the quantity dissolved from the positive plate. In many cases the difference did not exceed 3 per cent., though occasionally it rose to 50 per cent. The average difference, however, was 25 per cent. In some cases double the quantity dissolved was deposited, in others the reverse occurred—both resulting from alterations made in the respective processes; for in these experiments, the state of the solution and the relative sizes of the negative and positive electrodes were varied, as far as practicable. The most simple method of keeping a constant register of the state of the solution is to weigh the gold electrode before putting it into the solution; and, when taking it out, to compare the loss with the amount deposited. A little allowance, however, must be made for small portions of metal dissolved in the solution, from the articles that are gilt, which, when gilding is performed daily, is considerable in a year. A constant control can thus be exercised over the solution, to which there will have to be added from time to time a little cyanide of potassium, a simple test of requirement being that the gold positive electrode should always come out clean, for if it has a film or crust it is a certain indication that the solution is deficient of cyanide of potassium. Care must be taken to distinguish this crust, which is occasionally dark-green or black, from a black appearance, which the gold electrode will take when very small in comparison to the article being gilt, and which is caused by the tendency to evolve gas. In this case an addition of cyanide of potassium would increase the evil. The black appearance from the tendency to the escape of gas has a slimy appearance. This generally takes place when the solution is nearly exhausted of gold, of which fact this appearance, taken conjointly with the relative sizes of the electrodes, is a sure guide.

3734. To Regulate the Color of the Gilding. The gold upon the gilt article, on coming out of the solution, should be of a dark yellow color, approaching to brown; but this, when scratched (*see No.* 3709), will yield a beautifully rich deep gold. If the color is blackish it ought not to be finished, for it will never either brush or burnish a good color. If the battery is too strong, and gas is given off from the article, the color will be black; if the solution is too cold, or the battery rather weak, the gold will be light-colored; so that every variety of shade may be imparted. A very rich dead gold may be made by adding ammoniuret of gold (*see No.* 3725) to the solution just as the articles are being put in; or, what is better, add some sulphuret of carbon in the same way as for silver solutions (*see No.* 3710), which affects the color and appearance of the gold in the same way as it does the silver.

3735. To Improve the Color of Gilding. A defective colored gilding may be improved by the help of the following mixture: 3 parts nitrate of potassa (saltpetre), 1½ parts alum, 1½ parts sulphate of zinc, and 1½ parts common salt, are put into a small quantity of water, to form a sort of paste, which is put upon the articles to be colored; these are then placed upon an iron plate over a clear fire, so that they will attain nearly to a black heat, when they are suddenly plunged into cold water. This gives them a beautiful high color. Different hues may be had by a variation in the mixture.

3736. To Electro-gild with Red Gold. Gold having the red color of 14 carat gold may be deposited by the battery in the following manner: Prepare a solution of cyanide of copper by adding cyanide of potassium to a solution of sulphate of copper until the precipitate at first thrown down is redissolved. Add to this a solution of cyanide of gold (*see No.* 3727) in sufficient quantity to give, on trial, the desired color of gold deposit. When using this solution, the positive electrode plate should be of gold of the same color as that desired to be deposited.

3737. Practical Suggestions in Electro-gilding. According to the amount of gold deposited, so will be its durability. A few grains will serve to give a gold color to a very large surface, but it will not last. This proves, however, that the process may be used for the most inferior quality of gilding. Gold thinly laid upon silver will be of a light color, because of the property of gold to transmit light. The solution for gilding silver should be made very hot, but for copper it should be at its minimum heat. A mere blush may be sufficient for articles not subjected to wear; but on watch cases, pencil cases, chains, and the like, a good coating should be given. An ordinary sized watch case should have from 20 grains to a pennyweight; a mere coloring will be sufficient for the inside, but the outside should have as much as possible. A watch case thus gilt, for ordinary wear, will last five or six years without becoming bare. Small silver chains should have 12 grains; pencil cases of ordinary size should have from three to five grains; a thimble from 1 to 2 grains. These suggestions will serve as a guide to amateur gilders, many of whom, having imparted only a color to their pencil cases, feel disappointed upon seeing them speedily become bare; hence arises much of the obloquy thrown upon the process.

3738. To Deposit Copper, Silver, or Gold by the Battery on Paper and other Fibrous Material. The whole question is to make the paper a good conductor of electricity without coating it with a material which may peel off. One of the best methods is to take a solution of nitrate of silver, pour in liquid ammonia till the precipitate at first formed is entirely dissolved again, and place the paper, silk, or muslin for one or two hours in this solution. After taking it out and drying well, it is exposed to a current of hydrogen gas, by which operation the silver is reduced to a metallic state, and the material becomes so good a conductor of electricity that it may be electroplated with copper, silver, or gold, in the usual manner.

3739. To Dissolve Gold from Gilt Articles. Before regilding articles which are partly covered with gold, or when the gilding is imperfect, and the articles require regilding, the gold should be removed from them by putting them into strong nitric acid; and when the articles have been placed in the acid, by adding some common salt, not in solution, but in crystals. By this method gold may be dissolved from any metal, even from iron, without injuring it in the least. After coming out of the acid, the articles must be polished. The best method, however, is to brush off the gold as described for silver (*see No.* 3706), which gives the polish at the same time.

3740. To Recover Gold from its Acid Solution. When the acid has become saturated by the gold that has been dissolved in it, or when it ceases to dissolve the gold rapidly, it is diluted with several times its bulk of water, and then soda or potash added till the greater portion of the acid is neutralized. A solution of sulphate of iron (copperas) is then added, so long as a precipitate is formed; when this settles down it is carefully collected upon a paper filter, washed and dried, and then fused in a crucible with a little borax and common salt, when the gold is found as a button at the bottom of the crucible. When the gold is brushed off, the brushings are burned at a red heat, and the residue fused with carbonate of soda and a little borax; in this case, the gold will not be pure, and will have to be refined.

3741. To Separate Gold from Gilt Copper or Silver. Take a solution of borax in water, apply to the gilt surface, and sprinkle over it some finely powdered sulphur; make the article red hot, and quench it in water; then scrape off the gold, and recover it by means of lead. (*See No.* 3191.)

3742. To Recover Gold from Gilt Articles. Gold may be stripped from articles that have been gilt by placing them in strong nitric acid, in which some salt has been previously dissolved. When a number of articles have been stripped in the solution, it begins to work slowly, and it is time then to abandon it, and use a new one. The gold may then be recovered from the old solution, by evaporating it to dryness, and fusing the residuum with a small piece of soda or potash, the gold being fused into a button. The addition of a little saltpetre will tend to make the refining process more complete. As there is some trouble connected with this process, it is scarcely worth adopting where very small quantities of gold are concerned. In such a case it is a better plan to suspend the article, from which the gold is to be removed, in the gilding bath, in the place of the anode, when gilding another article.

3743. Electro-Gilding Without a Battery. Dissolve 9 parts terchloride of gold in 1000 to 2000 parts pure water; then add 360 parts bicarbonate of potassa, and boil for two hours. The metallic article, if not copper, is covered with a film of copper simultaneously with its being immersed into the boiling gilding liquor, by placing a piece of sheet-copper along with it. As soon as a deposit of copper is observed, the piece of copper is taken out, and the liquor continued boiling until a deep yellow color is obtained. The article is then taken out, washed off with water, and rubbed with a metallic brush. When the liquor has again become clear by settling and decanting, it is again heated to boiling, the article immersed, while the piece of copper is moved about in the fluid without touching the other. The same operation may be renewed *ad libitum*, until the desired thickness of gold is obtained.

3744. Plating and Gilding Without a Battery. Watts gives the following very useful solution of silver or gold for plating or gilding without the aid of a battery: Take 1 ounce nitrate of silver, dissolved in 1 quart distilled or rain water. When thoroughly dissolved, throw in a few crystals of hyposulphite of soda, which will at first form a brown precipitate, but which eventually becomes redissolved if sufficient hyposulphite has been employed. A slight excess of this salt must, however, be added. The solution thus formed may be used for coating small articles of steel, brass, or German silver, by simply dipping a sponge in the solution and rubbing it over the surface of the article to be coated; the silver becomes so firmly attached to the steel (when the solution has been carefully made) that it is removed with considerable difficulty. A solution of gold may be made in the same way, and applied as described. A concentrated solution of either gold or silver, thus made, may be used for coating parts of articles which have stripped or blistered, by applying it with a camel-hair pencil to the part, and touching the spot at the same time with a thin clean strip of zinc.

3745. To Distinguish Gold from its Imitations. The ordinary method of testing gold by the touchstone is founded upon the insolubility of this metal in nitric acid. If a mark be made on the touchstone with the article under examination, the gold is not dissolved by this acid, whereas golden colored alloys of inferior value are dissolved and disappear immediately. When articles are very thinly gilded, the detection of the gold in this manner is uncertain, in which case the following method may be used with advantage. (*See No.* 3190.)

3746. Test Fluid for Gilded Articles. A little carbonate of copper is put into a test-tube, and to this is added, drop by drop, pure hydrochloric acid, till the blue powder has dissolved to a clear green fluid, occasionally warming it over a spirit lamp. This concentrated solution of chloride of copper is diluted for use with from 10 to 11 times its volume of distilled water.

3747. To Test Gilded Articles. Before testing, the metallic surface must be well cleaned. This can be done effectually by brushing it for a minute or two with a little spirits of wine, or, better, with absolute alcohol. The surface having dried, a little of the testing fluid (*see last receipt*) is dropped on and allowed to remain in contact for about a minute. The fluid is then removed by means of a small pipette, and the surface of the metal completely dried with bibulous paper; if no dark spot be then visible, the article is coated with pure gold. If the metallic surface is but lightly gilded, a very slight blackening is sometimes remarked, which may throw a doubt upon the result. In such a case, to make quite certain, a little of the surface may be scraped off, and then the testing fluid again applied. If a dark spot is then perceived, the article may be considered as very thinly gilded.

Electroplating with Various Metals.

The following receipts furnish the means of coating objects with tin, zinc, brass, German silver, and other metals.

3749. To Electroplate Copper, Brass, or German Silver, with Aluminum, take equal measures of sulphuric acid and water, or take 1 measure each sulphuric and hydrochloric acids and 2 measures water; add to the water a small quantity of pipe-clay, in the proportion of 5 or 10 grains by weight to every ounce by measure of water (or ½ ounce to the pint). Rub the clay with the water until the two are perfectly mixed, then add the acid to the clay solution, and boil the mixture in a covered glass vessel 1 hour. Allow the liquid to settle, take the clear, supernatant solution, while hot, and immerse in it an earthen porous cell, containing a mixture of one measure of sulphuric acid and ten measures of water, together with a rod or plate of amalgamated zinc; take a small Smee's battery of 3 or 4 cells, and connect its positive pole by a wire with the piece of zinc in the porous cell. Having perfectly cleaned the surface of the article to be coated, connect it by a wire with the negative pole of the battery, and immerse it in the hot clay solution; immediately abundance of gas will be evolved from the whole of the immersed surface of the article, and in a few minutes, if the size of the article is adapted to the quantity of the current of electricity passing through it, a fine white deposit of aluminum will appear all over the surface. It may then be taken out, washed quickly in clean water, and wiped dry, and polished; but if a thicker coating is required, it must be taken out when the deposit becomes dull in appearance, washed, dried, polished, and reimmersed; and this must be repeated at intervals, as often as it becomes dull, until the required thickness is obtained. With small articles it is not absolutely necessary that a separate battery be employed, as the article to be coated may be connected, as in the one cell method (*see No.* 3669), by a wire with the piece of zinc in the porous cell, and immersed in the outer liquid, when it will receive a deposit, but more slowly than when a battery is employed.

3750. To Electroplate with Tin. Tin is easily deposited from a solution of protochloride of tin. If the two poles or electrodes be kept about 2 inches apart, a most beautiful phenomenon may be observed. The decomposition of the solution is so rapid that it shoots out from the negative electrode like feelers, towards the positive, which it reaches in a few seconds. The space between the poles seems like a mass of crystallized threads, and the electric current passes through them without affecting further decomposition. So tender are these metallic threads that when lifted out of the solution they fall upon the plate like cobweb. Seen through a glass they exhibit a beautiful crystalline structure. Tin may also be deposited from its solution in caustic potash or soda.

3751. Galvanic Tinning. M. Maistrasse-Dupré, it appears, had been commissioned by the French government to apply, by galvanic means, tin upon divers objects which had been made of so-called galvanized iron—that is, iron covered with zinc. To this purpose he applied galvanic elements made of copper and zinc plates, the length of which is 48 inches, the width 28 inches, placed in a leaden trough and separated and isolated by means of wooden partitions. The copper sheet was immersed in a mixture of equal parts of acetate of lead and common salt, and the zinc element was placed in weak sulphuric acid, specific gravity 1.060. This battery remains in constant action and working order for 8 days, at an outlay of only 2 francs. When the objects which are galvanically tinned are afterwards heated to the melting point of tin, the goodness and durability of hot-tinned materials is thus obtained. Copper thus tinned (galvanically), and afterwards heated, is superficially converted into bell metal, while the method of tinning galvanically has the great advantage over the old method, that it can be applied to objects to which the method of tinning in ordinary use is not applicable.

3752. To Electroplate with Brass. Brass can be deposited when the solution is composed of 1 part sulphate of copper in 4 parts hot water, 8 parts sulphate of zinc in 16 parts of hot water, 18 parts cyanide of potassium in 36 parts of hot water. These are mixed, and 250 parts of water added. Instead of a copper positive electrode plate, one of brass is necessary; the solution is required to be kept nearly boiling, and a powerful battery to be used.

3753. To Prepare Cyanides of Copper and Zinc. For copper, dissolve 1 ounce of sulphate of copper in 1 pint of hot water. For zinc, dissolve 1 ounce of the sulphate of zinc in 1 pint of hot water, and proceed the same as for cyanide of silver. (*See No.* 3697.)

3754. Cyanide Solution of Copper or Zinc. Dissolve 8 ounces (troy) cyanide of potassium, and 3 ounces cyanide of copper or zinc in 1 gallon of rain or distilled water. They should be used at about 160° Fahr.; with a compound battery of 3 to 12 cells.

3755. Cyanide Solution of Copper. To prepare copper solutions by means of cyanide of potassium, for covering iron and other positive metals, there are several methods, but the method adopted in manufacturing purposes is as follows: To a solution of sulphate of copper, add a solution of ferrocyanide of potassium (yellow prussiate of potassa), so long as a precipitate continues to be formed; this is allowed to settle, and, the clear liquor being decanted, the vessel is filled with water, and when the precipitate settles, the liquor is again decanted, and these washings are repeated until the sulphate of potash is washed quite out. This is known by adding a little chloride of barium to a small quantity of the washings; if no white precipitate is formed by this test, the precipitate is sufficiently washed. A solution of cyanide of potassium is now added to this precipitate until it is dissolved, during which process the solution becomes warm by the chemical reaction that takes place. The solution is filtered, and allowed to repose all night. If the solution of cyanide of potassium that is used is strong, the greater portion of the ferrocyanide of potassium crystallizes in the solution, and may be collected and preserved for use again. If the solution of cyanide of potassium used to dissolve the precipitate is dilute, it will be necessary to condense the liquor by evaporation, to obtain the yellow prussiate in crystals; the remaining solution is the coppering solution. Should it not be convenient to separate the yellow prussiate by crystallization, the presence of that salt in the solution does not interfere with its power of depositing copper.

3756. To Prepare Iron for Coating with Copper. When it is required to cover an iron article with copper, it is first steeped in hot caustic potash or soda, to remove any grease or oil. Being washed from that, it is placed for a short time in dilute sulphuric acid, consisting of about 1 part of acid to 16 parts water, which removes any oxide that may exist. It is then washed in water, and scoured with sand till the surface is perfectly clean, and finally attached to the battery, and immersed in the cyanide solution. (*See No.* 3755.) All this must be done with dispatch, so as to prevent the iron combining with oxygen. An immersion of five minutes' duration in the cyanide solution is sufficient to deposit upon the iron a film of copper. But it is necessary to the complete protection of the iron, that it should have a tolerably thick coating; and, as the cyanide process is expensive, it is preferable, when the iron has received a film of copper by the cyanide solution, to take it out, wash it in water, and attach it to a single cell or weak battery, and put it into a solution of sulphate of copper. If there is any part not sufficiently covered with copper by the cyanide solution, the sulphate will make these parts of a dark color, which a touch of the finger will remove. When such is the case, the article must be taken out, scoured, and put again into the cyanide solution till perfectly covered. A little practice will render this very easy. The sulphate solution, when used for covering iron, should be prepared by adding to it by degrees a little caustic soda, so long as the precipitate formed is redissolved. This neutralizes a great portion of the sulphuric acid, and thus the iron is not so readily acted upon.

3757. To Coat Iron with Zinc. In covering iron with zinc, the precautions necessary for copper are not required; zinc being the positive metal, acids have a stronger affinity for it than for iron, and therefore an acid solution may be used. The solution generally used is the sulphate, used in the same way as sulphate of copper. (*See No.* 3661.)

3758. Test for Galvanized Iron. When zinc is deposited on iron by galvanic agency, it should form a chemical combination with the iron, and not be merely attached thereto. It is proposed by Mr. T. Bruce Warren, of England, to use this fact for practically testing the efficiency of the galvanization. If mercury be poured over the surface, the zinc that is only locally attached will form an amalgam with the mercury. Mr. Warren also uses this as a quantitative test, to verify the amount of zinc in combination with the iron.

3759. To Make a Cyanide Solution of Brass. Dissolve 1 pound (troy) cyanide of potassium, 2 ounces cyanide of copper, and 1 ounce cyanide of zinc, in 1 gallon rain or distilled water; then add 2 ounces muriate of ammonia. This solution is to be used at 160° Fahr. on smooth work, with a compound battery of 3 to 12 cells.

3760. Electroplating with Platinum. This metal has never yet been successfully deposited as a protecting coating to other metals. A solution may be made by dissolving it in a mixture of nitric and muriatic acids, the same as is employed in dissolving gold; but heat must be applied. The solution is then evaporated to dryness, and to the remaining mass is added a solution of cyanide of potassium; next, it must be slightly heated for a short time, and then filtered. This solution, evaporated, yields beautiful crystals of cyanide of platinum and potassium; but it is unnecessary to crystallize the salt. A very weak battery power is required to deposit the metal; the solution should be heated to 100°. Great care must be taken to obtain a fine metallic deposit; indeed, the operator may not succeed once in twenty times in getting more than a mere coloring of metal over the surface, and that not very adhesive. The causes of the difficulty are probably these: the platinum used as an electrode is not acted upon; the quantity of salt in solution is very little; it requires a particular battery strength to give a good deposit, and the slightest strength beyond this gives a black deposit; so that, were the proper relations obtained, whenever there is any deposit, the relations of battery and solution are changed, and the black pulverulent deposit follows.

3761. Electroplating with Palladium. Palladium is a metal very easily deposited. The solution is prepared by dissolving the metal in nitro-muriatic acid, and evaporating the solution nearly to dryness; then adding cyanide of potassium till the whole is dissolved; the solution is then filtered and ready for use. The cyanide of potassium holds a large quantity of this metal in solution, and the electrode is acted upon while the deposit is proceeding. Articles covered with this metal assume the appearance of the metal; but so far as we are aware, it has not yet been applied to any practical purpose. It requires rather a thick deposit to protect metals from the action of acids, which is, probably, the only use it can be applied to.

3762. Electroplating with Nickel. Nickel is very easily deposited, and may be prepared for this purpose by dissolving it in nitric acid, then adding cyanide of potassium to precipitate the metal; after which the precipitate is washed and dissolved by the addition of more cyanide of potassium. Or the nitrate solution may be precipitated by carbonate of potash; this should be well washed, and then dissolved in cyanide of potassium; a proportion of carbonate of potash will be in the solution, which has not been found to be detrimental. The metal is very easily deposited; it yields a color approaching to silver, which is not liable to tarnish on exposure to the air. A coating of this metal would be very useful for covering common work, such as gasaliers, and other gas-fittings, and even common plate. The great difficulty experienced is to obtain a positive electrode: the metal is very difficult to fuse, and so brittle that we have never been able to obtain either a plate or a sheet of it. Could this difficulty be easily overcome, the application of nickel to the coating of other metals would be extensive, and the property of not being liable to tarnish would make it eminently useful for all general purposes.

3763. Nagel's Method of Electroplating with Nickel. A process devised by Mr. Nagel, of Hamburg, for coating iron, steel, and other oxidizable metals with an electro deposit of nickel or cobalt, consists in taking 4 parts, by weight, of pure sulphate of the protoxide of nickel by crystallization, and 2 parts, by weight, of pure ammonia, so as to form a double salt, which is then dissolved in 60 parts of distilled water, and 12 parts of ammoniacal solution of the specific gravity of .909 added. The electro deposit is effected by an ordinary galvanic current, using a platinum positive pole, the solution being heated to about 100° Fahr. The strength of the galvanic current is regulated according to the number of objects to be coated.

3764. To Protect Steel from Rusting. It has been found by experiment that an electro-deposited coating of nickel protects the surface of polished steel completely from rust. Swords, knives, and other articles of steel liable to exposure, may be coated with nickel without materially altering the color of the metal.

3765. To Protect Copper and Brass. Copper and brass are equally well protected by nickel (*see No.* 3764), but, of course, with change of color on the surface. The nickel facing, when burnished, has a whiter color than polished steel, but not as white as silver, being nearer in appearance to platinum.

3766. Nagel's Method of Electroplating Metal with Cobalt. For coating with cobalt, 138 parts, by weight, of pure sulphate of cobalt, are combined with 69 parts of pure ammonia, to form a double salt, which is then dissolved in 1000 parts of distilled water, and 120 parts of ammoniacal solution, of the same specific gravity as before, are added. The process of deposition with cobalt is the same as with nickel. (*See No.* 3763.)

3767. To Electroplate with Silicium. In the following manner, a coating of silicium can be obtained direct from silica: Take the following proportions: ¾ ounce, by measure, of hydrofluoric acid, ¼ ounce hydrochloric acid, and 40 or 50 grains either of precipitated silica, or of fine white sand (the former dissolves most freely), and boil the whole together for a few minutes, until no more silica is dissolved. Use this solution exactly in the same manner as the clay solution (*see No.* 3767), and a fine white deposit of metallic silicium will be obtained, provided that the size of the article is adapted to the quantity of the electric current. Common red sand, or, indeed, any kind of silicious stone, finely powdered, may be used in place of the white sand, and with equal success, if it be previously boiled in hydrochloric acid, to remove the red oxide of iron or other impurities. In depositing both aluminum and silicium, it is necessary to well saturate the acid with the solid ingredients by boiling, otherwise very little deposit of metal will be obtained.

3768. To Prepare a Brass Solution. For each gallon of water used to make the solution, take 1 pound carbonate of ammonia, 1 pound cyanide of potassium, 2 ounces cyanide of copper, and 1 ounce cyanide of zinc. This constitutes the solution for the decomposing cell. It may be prepared, also, from the above proportions of carbonate of ammonia and cyanide of potassium, by immersing in it a large sheet of brass of the desired quality, and making it the anode or positive electrode of a powerful galvanic battery or magneto-electric machine; and making a small piece of metal the cathode or negative electrode, from which hydrogen must be freely evolved. This operation is continued till the solution has taken up a sufficient quantity of the brass to produce a reguline deposit.

3769. To Electroplate with Brass. The solution (*see No.* 3768) may be used cold; but it is desirable, in many cases, to heat it (according to the nature of the articles to be deposited upon) to 212° Fahr. For wrought or fancy work, about 150° Fahr. will give excellent results. The galvanic battery, or magneto-electric machine, must be capable of evolving hydrogen freely from the cathode or negative electrode, or article attached thereto. It is preferred to have a large anode or positive electrode, as this favors the evolution of hydrogen. The article or articles treated as before described will immediately become coated with brass. By continuing the process, any desired thickness may be obtained. Should the copper have a tendency to come down in a greater proportion than is desired, which may be known by the deposit assuming too red an appearance, it is corrected by the addition of carbonate of ammonia, or by a reduction of temperature, when the solution is heated. Should the zinc have a tendency to come down in too great a proportion, which may be seen by the deposit being too pale in its appearance, this is corrected by the addition of cyanide of potassium or by an increase of temperature.

3770. To Electroplate with German Silver. The alloy, German silver, is deposited by means of a solution consisting of carbonate of ammonia and cyanide of potassium (in the proportions given above for the brass), and cyanides or other compounds of nickel, copper, and zinc, in the requisite proportions to constitute German silver. It is, however, preferred to make the solution by means of the galvanic battery or magneto-electric machine, as above described for brass. Should the copper of the German silver come down in too great a proportion, this is corrected by adding carbonate of ammonia, which brings down the zinc more freely; and should it be necessary to bring down the copper in greater quantity, cyanide of potassium is added—such treatment being similar to that of the brass before described.

Bronzing.

This is the process of giving a bronze-like or an antique metallic appearance to the surface of copper, brass, and other metals. This is generally effected by the action of some substance which combines with and changes the nature of the surface of the metal. The application of powdered bronzing substances, made to adhere by sizing, &c., to the surface of other material than metal, such as wood, plaster, &c., is termed surface bronzing. (*See Nos.* 3382, *&c.*)

3772. Brown Bronzes for Medals, &c. Take a wine-glass of water, and add to it 4 or 5 drops nitric acid; with this solution wet the medal (which ought to have been previously well cleaned from oil or grease) and then allow it to dry; when dry impart to it a gradual and equable heat, by which the surface will be darkened in proportion to the heat applied.

3773. Bronzing with Crocus. Make a thin paste of crocus and water; lay this paste on the face of the medal, which must then be put into an oven, or laid on an iron plate over a slow fire; when the paste is perfectly reduced to powder, brush it off and lay on another coating; at the same time quicken the fire, taking care that the additional heat is uniform; as soon as the second application of paste is thoroughly dried, brush it off. The medal being now effectually secured from grease, which often occasions failures in bronzing, coat it a third time, but add to the strength of the fire, and sustain the heat for a considerable time; a little experience will soon enable the operator to decide when the medal may be withdrawn; the third coating being removed, the surface will present a beautiful brown bronze. If the bronze is deemed too light the process can be repeated.

3774. Bronzing with Black-Lead. After the medal has been well cleaned from wax or grease, by washing it in a little caustic alkali, brush some black-lead over the face of it, and then heat it in the same way as described in No. 3773 for crocus; or a thin paste of black-lead may be used, and the processes already referred to be repeated until the desired brown tint is obtained. In this kind of bronze a little hematitic iron ore, which has an unctuous feel, may be brushed over the face of the bronze, by which a beautiful lustre is imparted to it, and a considerable variety in the shade may be obtained. In the brown bronzes the copper is slightly oxidized on the surface.

3775. Plumbago Bronze. This bronze is obtained by brushing the surface of the medal with plumbago, then placing it on a clear fire till it is made too hot to be touched, and applying a plate brush so soon as it ceases to be hot enough to burn the brush. A few strokes of the brush will produce a dark brown polish, approaching black, but entirely distinct from the well known appearance of black-lead. If the same operation is performed on a medal that has been kept some days, or upon one that has been polished, a different, but very brilliant tint is produced. The color is between red and brown. The richness of color thus produced is by many preferred to the true dark brown.

3776. Chinese Bronze. Take 2 ounces each verdigris and vermilion; 5 ounces each alum and sal-ammoniac, all in fine powder, and sufficient vinegar to make a paste; then spread it over the surface of the copper, previously well cleaned and brightened; uniformly warm the article by the fire, and afterwards well wash and dry it, when, if the tint be not deep enough, the process may be repeated. The addition of a little sulphate of copper inclines the color to a chestnut brown; and a little borax to a yellowish brown. Much employed by the Chinese for copper tea-urns.

3777. Carbonate of Iron Bronze. Beautiful tints are produced by using plate-powder or rouge. After moistening with water, it is applied and treated in precisely the same manner as the plumbago. (*See No.* 3775.)

3778. Black Bronzes. A very dark colored bronze may be obtained by using a little sulphuretted alkali (sulphuret of ammonia is best). The face of the medal is washed over with the solution, which should be dilute, and the medal dried at a gentle heat, and afterwards polished with a hard hair brush. Sulphuretted hydrogen gas is sometimes employed to give this black bronze, but the effect of it is not so good, and the gas is very deleterious when breathed. In these bronzes the surface of the copper is converted into a sulphuret.

3779. German Method of Bronzing Brass Black. There are two methods of procuring a black lacquer upon the surface of brass. The one which is that usually employed for optical and scientific instruments, consists in first polishing the object with Tripoli, then washing it with a mixture composed of 1 part nitrate of tin and 2 parts chloride of gold, and, after allowing this wash to remain on for about 12 or 15 minutes, wiping it off with a linen cloth. An excess of acid increases the intensity of the tint. In the other method, copper turnings are dissolved in nitric acid until the acid is saturated; the objects are immersed in the solution, cleaned, and subsequently heated moderately over a charcoal fire. This process must be repeated in order to produce a black color, as the first trial only gives a deep green; when the desired color is attained, the finishing touch is given by polishing with olive oil.

3780. Black Bronzes. Many metallic solutions, such as weak acid solutions of platinum, gold, palladium, antimony, etc., will impart a dark color to the surface of medals when they are dipped into them. The medal, after being dipped into the metallic solution, is to be well washed and brushed. In such bronzes the metals contained in the solution are precipitated upon the face of the copper medal, which effect is accompanied by a partial solution of the copper.

3781. Green Bronzes for Figures and Busts. Green bronzes require a little more time than those already described. They depend upon the formation of an acetate, carbonate, or other green salt of copper upon the surface of the medal. Steeping for some days in a strong solution of common salt will give a partial bronzing which is very beautiful, and, if washed in water and allowed to dry slowly, is very permanent. Sal ammoniac may be substituted for common salt. Even a strong solution of sugar, alone, or with a little acetic or oxalic acid, will produce a green bronze; so also will exposure to the fumes of dilute acetic acid, to weak fumes of hydrochloric acid, and to several other vapors. A dilute solution of ammonia allowed to dry upon the copper surface will leave a green tint, but not very permanent.

3782. Bronzing with Bleaching Powder. Electrotypes may be bronzed green, having the appearance of ancient bronze, by a very simple process. Take a small portion of bleaching powder (chloride of lime), place it in the bottom of a dry vessel, and suspend the medal over it, and cover the vessel; in a short time the medal will acquire a green coating, the depth of which may be regulated by the quantity of bleaching powder used, or the time that the medal is suspended in its fumes; of course, any sort of vessel, or any means by which the electrotype may be exposed to the fumes of the powder, will answer the purpose; a few grains of the powder is all that is required. According as the medal is clean or tarnished, dry or wet, when suspended, different tints, with different degrees of adhesion, will be obtained.

3783. Fine Green Bronze. Dissolve 2 ounces verdigris and 1 ounce sal-ammoniac in 1 pint vinegar, and dilute the mixture with water until it tastes but slightly metallic, when it must be boiled for a few minutes, and filtered for use. Copper medals, &c., previously thoroughly cleaned from grease and dirt, are to be steeped in the liquor at the boiling point, until the desired effect is produced. Care must be taken not to keep them in the solution too long. When taken out, they should be carefully washed in hot water, and well dried. Gives an antique appearance.

3784. To Bronze Brass Orange, Greenish Grey and Violet Tint. An orange tint, inclining to gold, is produced by first polishing the brass, and then plunging it for a few seconds into a neutral solution of crystallized acetate of copper, care being taken that the solution is completely destitute of all free acid, and possesses a warm temperature. Dipped into a bath of copper, the resulting tint is a greyish green, while a beautiful violet is obtained by immersing it for a single instant in a solution of chloride of antimony, and rubbing it with a stick covered with cotton. The temperature of the brass at the time the operation is in progress has a great influence upon the beauty and delicacy of the tint; in the last instance it should be heated to a degree so as just to be tolerable to the touch.

3785. Moire Bronze. A moire appearance, vastly superior to that usually seen, is produced by boiling the object in a solution of sulphate of copper. According to the proportions observed between the zinc and the copper in the composition of the brass article, so will the tints obtained vary. In many instances it requires the employment of a slight degree of friction with a resinous or waxy varnish, to bring out the wavy appearance characteristic of moire, which is also singularly enhanced by dropping a few iron nails into the bath.

3786. French Bronze. An eminent Parisian sculptor makes use of a mixture of ½ ounce sal-ammoniac, ½ ounce common salt, 1 ounce spirits of hartshorn, and 1 imperial quart of vinegar. A good result will also be obtained by substituting an additional ½ ounce sal-ammoniac, instead of the spirits of hartshorn. The piece of metal, being well cleaned, is to be rubbed with one of these solutions, and then dried by friction with a clean brush. If the hue be found too pale at the end of 2 or 3 days, the operation may be repeated. It is found to be more advantageous to operate in the sunshine than in the shade.

3787. To Bronze Copper with Sulphur. When objects made of copper are immersed in melted sulphur mixed with lampblack, the objects so treated obtain the appearance of bronze, and can be polished without losing that aspect.

3788. Antique Bronze. Dissolve 1 ounce sal-ammoniac, 3 ounces cream of tartar, and 6 ounces common salt, in 1 pint hot water; then add 2 ounces nitrate of copper, dissolved in ½ pint water; mix well, and apply it repeatedly to the article, placed in a damp situation, by means of a brush moistened therewith. This produces a very antique effect.

3789. Antique Bronze. Rub the medal with a solution of sulphuret of potassium, then dry. This produces the appearance of antique bronze very exactly.

3790. Bronzing Liquids for Tin Castings. Wash them over, after being well cleaned and wiped, with a solution of 1 part sulphate of iron, and 1 part sulphate of copper, in 20 parts water; afterwards with a solution of 4 parts verdigris in 11 of distilled vinegar; leave for an hour to dry, and then polish with a soft brush and crocus.

3791. To Bronze Iron Castings. Iron castings may be bronzed by thorough cleaning (*see No.* 3641) and subsequent immersion in a solution of sulphate of copper, when they acquire a coat of the latter metal. They must be then washed in water.

3792. Surface Bronzing. This term is applied to the process of imparting to the surfaces of figures of wood, plaster of Paris, &c., a metallic appearance. This is done by first giving them a coat of oil or size varnish, and when this is nearly dry, applying with a dabber of cotton or a camel-hair pencil, any of the metallic bronze powders; or the powder may be placed in a little bag of muslin, and dusted over the surface, and afterwards finished off with a wad of linen. The surface must be afterwards varnished.

3793. To Bronze Paper. Paper is bronzed by mixing the powders up with a little gum and water, and afterwards burnishing. The paper used should contain sufficient sizing not to absorb the gum.

3794. Beautiful Red Bronze Powder. Mix together sulphate of copper, 100 parts; carbonate of soda, 60 parts; apply heat until they unite into a mass, then cool, powder, and add copper filings, 15 parts; well mix, and keep them at a white heat for 20 minutes, then cool, powder, wash thoroughly with water, and dry.

3795. Gold Colored Bronze Powder. Verdigris, 8 ounces; tutty powder, 4 ounces; borax and nitre, each 2 ounces; bichloride of mercury, ½ ounce; make them into a paste with oil, and fuse them together. Used in japanning as a gold color. Or: Grind Dutch foil or pure gold leaf to an impalpable powder. (*See Nos.* 2491 *and* 2517.)

3796. Silver White Bronze Powder. Melt together 1 ounce each bismuth and tin, then add 1 ounce running quicksilver; cool and powder.

3797. Graham's Quick Bronzing Liquids. The following 19 receipts are preparations for bronzing brass, copper, and zinc, by simple immersion. Their action is immediate.

3798. Black or Brown Bronzing for Brass, Copper, or Zinc. Dissolve 5 drachms nitrate of iron in 1 pint water. Or: 5 drachms perchloride of iron in 1 pint water. A black may also be obtained from 10 ounces muriate of arsenic in 2 pints permuriate of iron, and 1 pint water.

3799. Brown or Red Bronzing for Brass. Dissolve 16 drachms nitrate of iron, and 16 drachms hyposulphite of soda, in 1 pint water. Or: 1 drachm nitric acid may be substituted for the nitrate of iron.

3800. Red-Brown Bronzing for Brass. Dissolve 1 ounce nitrate of copper, and 1 ounce oxalic acid, in 1 pint water, brought to the boil, and then cooled. Or: 1 pint solution of ferrocyanide of potassium and 3 drachms nitric acid. This latter is slow in action, taking an hour to produce good results.

3801. Dark Brown Bronzing for Brass. Mix 1 ounce cyanide of potassium, and 4 drachms nitric acid, with 1 pint water.

3802. Red Bronzing for Brass. Mix 30 grains tersulphite of arsenic, 6 drachms solution of pearlash, and 1 pint water.

3803. Orange Bronzing for Brass. Mix 1 drachm potash solution of sulphur with 1 pint water.

3804. Olive Green Bronzing for Brass. Dissolve 1 pint permuriate of iron in 2 pints water.

3805. Slate-Colored Bronzing for Brass. Dissolve 2 drachms sulphocyanide of potassium, and 5 drachms perchloride of iron, in 1 pint water.

3806. Blue Bronzing for Brass. Mix 20 drachms hyposulphite of soda with 1 pint water.

3807. Steel-Grey Bronzing for Brass, or Copper. Mix 1 ounce muriate of arsenic with 1 pint water, and use at a heat not less than 180° Fahr.

3808. Dark Drab Bronzing for Copper. This is prepared by adding 2 drachms sulphocyanide of potassium to the mixture given in No. 3807. Or: mix 1 ounce sulphate of copper, 1 ounce hyposulphite of soda, 2 drachms hydrochloric acid, and 1 pint water.

3809. Bright Red Bronzing for Copper. Mix 2 drachms sulphide of antimony, and 1 ounce pearlash, in 1 pint water.

3810. Dark Red Bronzing for Copper. Dissolve 1 drachm sulphur, and 1 ounce pearlash, in 1 pint water.

3811. Dark Grey Bronzing for Zinc. Mix 1 drachm protochloride of tin, and 1 drachm sulphocyanide of potassium, with 1 pint water. Or: Dissolve 1 drachm each sulphate of copper and muriate of iron, in 2 pints water. A similar effect may be obtained by mixing muriate of lead with water to the consistency of cream.

3812. Green-Grey Bronzing for Zinc. Dissolve ½ drachm muriate of iron in 1 pint water.

3813. Red Bronzing for Zinc. Use garancine (madder-red) infusion boiling hot.

3814. Copper-Colored Bronzing for Zinc. Agitate the articles in a solution of 8 drachms sulphate of copper, and 8 drachms hyposulphite of soda, in 1 pint water.

3815. Copper-Colored Bronzing for Zinc Plates. Make a solution of 4 drachms sulphate of copper, and 4 drachms pearlash, in 1 pint water. Immerse the zinc plate in it, connected at one end with a plate of copper, as represented in Fig. I, No. 3665. This, it will be seen, induces a galvanic current, and is electroplating on a small scale.

3816. Purple Bronzing for Zinc. Immerse in a boiling infusion of logwood.

3817. Larkin's Bronzing Fluids for Alloys of a Silvery-Grey Color. Mr. Larkin states that, for the purpose of rendering alloys which are of a silvery-grey color, perfectly suitable as substitutes for copper, bronze, brass, and other metals, the color proper to the metals which they are intended to substitute is imparted to them by means of any solution of copper. The hydrochlorate of copper is found to answer best, and is employed as directed in the five following receipts.

3818. Directions for Using Larkin's Bronzing Fluids. In either of these methods of coloring, a solution of sal-ammoniac may be substituted for the liquid ammonia. The quantities of each ingredient have not been stated, as these depend upon the nature of the alloy, the shade or hue desired, and the durability required. The bluish-bronze color may be superadded to the red or copper color, whereby a beautiful light color is produced on the prominent parts of the article bronzed, or on the parts from which the blackish-bronze color may have been rubbed off. These new alloys may be used as substitutes for various metals now in general use, such as iron, lead, tin, or copper, in pipes and tubes; and bronze, brass, and copper, in machinery and manufactories, as well as for most of the other purposes for which more expensive metals are employed.

3819. Blackish Bronze Coloring. For giving silvery-grey alloys a blackish-bronze color, they are treated with a solution of hydrochlorate of copper diluted with a considerable quantity of water, and a small quantity of nitric acid may be added.

3820. Lead or Copper Coloring. To impart a lead or copper color, add to the solution of hydrochlorate of copper, liquid ammonia and a little acetic acid. The salt of copper may be dissolved in the liquid ammonia.

3821. Antique Bronze Coloring. To impart a brass or antique bronze color, either of the three following means may be adopted:—A solution of copper, with some acetic acid. Or:—The means before described for copper color, with a large proportion of liquid ammonia. Or:—Water acidulated with nitric acid, by which beautiful bluish shades may be produced. It must be observed, however, this last process can only be properly employed on the alloys which contain a portion of copper.

3822. Drab Bronze for Brass. Brass obtains a very beautiful drab bronze by being worked in moulders' damp sand for a short time and brushed up.

3823. To Make Bronze Powder for Plaster Casts, &c. To a solution of soda-soap in linseed oil, cleared by straining, add a mixture of 4 pints sulphate of copper solution, and 1 pint sulphate of iron solution, which precipitates a metallic soap of a peculiar bronze hue; wash with cold water, strain, and dry to powder.

3824. To Bronze Plaster Casts, &c. The powdered soap of the last receipt is thus applied: Boil 3 pounds pure linseed oil with 12 ounces finely powdered litharge; strain through a coarse canvas cloth, and allow to stand until clear; 15 ounces of this soap varnish, mixed with 12 ounces metallic soap powder (*see last receipt*), and 5 ounces fine white wax, are to be melted together at a gentle heat in a porcelain basin, by means of a water-bath, and allowed to remain for a time in a melted state to expel any moisture that it may contain; it is then applied with a brush to the surface of the plaster previously heated to 200° Fahr., being careful to lay it on smoothly, and without filling up any small indentations of the plaster design. Place it for a few days in a cool place; and, as soon as the smell of the soap varnish has gone off, rub the surface over with cotton wool, or fine linen rag, and variegated with a few streaks of metal powder or shell gold. Small objects may be dipped in the melted mixture, and exposed to the heat of a fire till thoroughly penetrated and evenly coated with it.

3825. To Make Bronzing for Wood. Grind separately to a fine powder, Prussian blue, chrome yellow, raw umber, lampblack, and clay, and mix in such proportions as will produce a desired dark green hue; then mix with moderately strong glue *size*.

3826. To Bronze Wood. First coat the clean wood with a mixture of size and lampblack; then apply two coats of the green colored sizing in the last receipt; and lastly with bronze powder, such as powdered Dutch foil, mosaic gold, &c., laid on with a brush. Finish with a thin solution of Castile soap; and, when dry, rub with a soft woolen cloth.

3827. To Bronze Porcelain, Stoneware, and Composition Picture Frames. A bronzing process, applicable to porcelain, stoneware, and composition picture and looking-glass frames is performed as follows: The articles are first done over with a thin solution of water-glass (*see No.* 2816) by the aid of a soft brush. Bronze powder is then dusted on, and any excess not adherent is knocked off by a few gentle taps. The article is next heated, to dry the silicate, and the bronze becomes firmly attached. Probably, in the case of porcelain, biscuit, or stoneware, some chemical union of the silicate will take place, but in other cases the water-glass will only tend to make the bronze powder adhere to the surface. After the heating, the bronze may be polished or burnished with agate tools.

3828. Browning for Gun Barrels. Mix 1 ounce each aqua-fortis and sweet spirits of nitre; 4 ounces powdered blue vitriol; 2 ounces tincture of iron, and water, 1½ pints; agitate until dissolved.

Or: Blue vitriol and sweet spirits of nitre, of each 1 ounce; water, 1 pint; dissolve as last.

Or: Mix equal parts of butter of antimony and sweet oil, and apply the mixture to the iron previously warmed.

3829. To Brown Gun Barrels. The gun barrel to be browned must be first polished and then rubbed with whiting to remove all oily matter. Its two ends should be stopped with wooden rods, which serve as handles, and the touch-hole filled with wax. Then rub on the solution (*see last receipt*) with a linen rag or sponge till the whole surface is equally moistened. Let it remain till the next day, then rub it off with a stiff brush. The liquid may be again applied until a proper color is produced. When this is the case, wash in pearlash water, and afterwards in clean water, and then polish, either with the burnisher or with bees' wax; or apply a coat of shellac varnish. (*See No.* 2954.)

Chemical Manipulations.

Some of the operations employed in the preparation and use of chemicals have already been given at the commencement of this book (*see No.* 1); but, as the work progressed, it was deemed advisable, for the sake of greater precision, to add further directions for special manipulations, and descriptions of indispensable apparatus.

3831. Separating Funnels. These are glass funnels furnished with a stop-cock, and are used for separating mixed fluids of different densities. The mixed liquid is poured into the funnel, and, after sufficient time has been allowed for the heavier liquid to settle, it can be drawn off by opening the stop-cock, closing it immediately after the heavy liquid

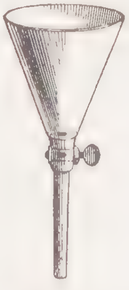


Fig. 1.

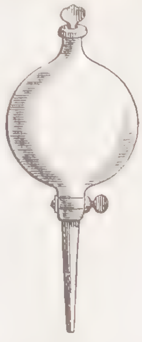


Fig. 2.

has passed. Fig. 1 represents a separating funnel, such as is used for ordinary purposes; but for separating a mixed liquid containing ether or other volatile fluid, a funnel, closed with a stopper similar in construction to Fig. 2, is employed to prevent evaporation while the heavier liquid is settling. For very small quantities a pipette (*see No.* 3832) is the best instrument.

3832. Pipettes. These are glass instruments used for measuring liquids in drops, and so constructed that the flow of the liquid from them is under the complete control of the operator. They may be made in any form which may be suggested to adapt them to special purposes; but pipettes for general use are usually constructed as follows: Fig. 1 is an ordinary pipette, and consists of a small cylinder of glass with an upper and lower tube, the lower end terminating in a fine orifice for the discharge of the fluid, and the upper end adapted for the finger or thumb, by which the outward flow can be instantly arrested. This is filled by the suction of the mouth. Fig. 2 is made on the same principle, having a fine orifice (*b*), and a thumb-hole (*a*), but fitted with a mouth and stopper on the upper side, for convenience of filling, or inserting a measured quantity of liquid. The lower side being flat, to allow of the instrument being laid down without risk of waste of contents.

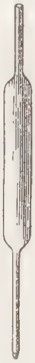


Fig. 1.

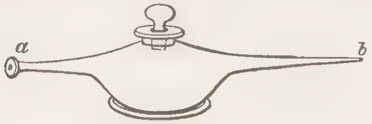


Fig. 2.

A pipette affords also a ready means of separating two liquids, too small in quantity to allow of separation by decantation or other methods usually employed. To this end, the upper or lower stratum of the mixed liquids (oil and water, for instance), may be drawn by the mouth into the pipette; or the whole may be sucked into the pipette, and the lower stratum allowed to flow out.

Graduated pipettes of various forms, especially useful in acidimetry, &c., will be found described in No. 82. These instruments are also useful, and in many cases indispensable, in conducting delicate tests.

3833. Goniometer. An instrument used for measuring the angles of crystals. The only accurate and simple instrument of this kind is the reflective goniometer invented by Dr. Wollaston.

3834. To Filter Vegetable Juices. These should be allowed to deposit their feculous matter before filtration. The supernatant liquid will often be found quite clear; when this is not the case, filtration will be necessary through coarse filtering paper. (*See No.* 17.) Some vegetable juices can be made clear simply by heating them to 180° to 200° Fahr., by which their albumen becomes coagulated.

Others admit of clarification in the same manner as syrups. (*See No.* 1357.) Many of these, again, such as hemlock, henbane, aconite, &c., are greatly injured by heat, and must be filtered or decanted after repose.

3835. To Filter Vegetable Infusions. In many instances vegetable infusions and decoctions may be clarified by defecation and decantation of the clear liquid. A convenient method of straining, when that is necessary, is by securing the corners of a square piece of flannel to a frame, which can be laid over the mouth of a pan; or by laying the flannel across the mouth of a coarse hair-sieve. Concentrated infusions and decoctions, being usually weak tinctures, may be filtered as tinctures. (*See No.* 17.) Viscid vegetable solutions may be clarified (*see No.* 1357); or may be made to filter rapidly by the addition of acetic, sulphuric, or other strong acid.

3836. To Filter Corrosive Liquids. Strong acids, &c., are filtered through powdered glass or siliceous sand, supported on pebbles in the throat of a glass funnel, or through asbestos placed in the same manner.

3837. To Filter Precipitates. When filtration is employed to separate precipitated matter from the solution in which it is suspended, the filtering medium should be such that the powder may be easily reclaimed from it with as little loss as possible. Linen or smooth bibulous paper are the best for this purpose. A camel-hair pencil should be used, if needed, in preference to a knife, to remove adhering powder from a filter, and the precipitate should be first washed down the sides of the filter by a small stream of water, so as to collect the most of it to one spot at the bottom.

The first runnings in filtration should always be returned to the filter.

3838. Bunsen's Method of Rapid Filtration. A great deal of time is frequently lost in washing precipitates, by having to wait for the liquid to pass through a filter. Bunsen's improvement consists in fixing the filtering funnel air-tight, by means of a perforated cork in the neck of a bottle which has an opening connected with the receiver of an air-pump. By exhausting the air in the bottle, the liquid will run faster through the filter in proportion to the diminution of the pressure in the bottle. Comparative experiments, some made according to the old, and others according to the new method, showing that the filtration, washing, and drying of a precipitate, which took 7 hours by the old plan, could be performed, by filtration into an exhausted bottle, in 13 minutes.

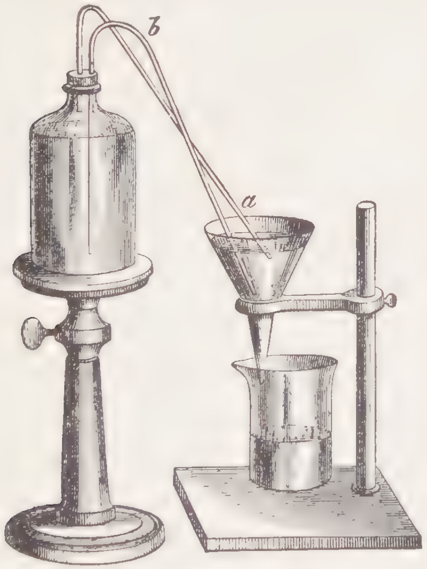
3839. Filtering Powders. In many cases a liquid will not readily become transparent by simply passing through the filter; hence has arisen the use of filtering powders, substances which rapidly choke up the pores of the media in a sufficient degree to make the fluid pass clear. These powders should not be in too fine a state of division, nor used in large quantities, as they then wholly choke up the filter, and absorb a large quantity of the liquid. For some liquids these substances are employed for the purpose of decoloring or whitening them. In such cases, it is preferable first to pass the fluid through a layer of the substance in coarse powder, from which it will run but slightly contaminated into the filters; or, if the substance be mixed with the whole body of the liquid, to pass it through some coarser medium, to remove the cruder portion, before allowing it to run into the filter. Fuller's earth, pipe clay, or potter's clay, washed, dried without heat, and reduced to coarse powder, are used to filter and bleach oils.

Fuller's earth or clay, 1 part, and 2 parts fine silicious sand, first separately washed and drained, then mixed together and dried, constitutes a filtering powder well adapted for glutinous oils.

Granulated animal charcoal, sifted and fanned free from dust, is used to filter and bleach syrups and vegetable solutions.

Carbonate of magnesia and powdered glass, or pumice stone, are used for filtering weak alcoholic solutions of essential oils, and in the preparation of perfumed waters. (*See Nos.* 976, 1029, 1080, *and* 1081.)

3840. Self-Feeding Filter. It is usually a matter of more or less importance in filtration, that the filter should be kept full. To effect this requires unremitting attention, which, when the filtration occupies a considerable time, is at least tedious. By the use of a simple apparatus, this is avoided, and filtration will continue, without any personal attention, until the operation is complete. A bottle or jar, of sufficient capacity to contain the liquid to be filtered, is placed in a convenient position, above the level of the filter (*see illustration*); through the cork, which must fit air-tight, are inserted two bent tubes; one end of the tube *b* must reach nearly to the bottom of the jar, the other end descending deep into the filter; the tube *a* terminates at one end just below the cork of the jar, the outer end being adjusted in the filter at the height which it is desired that the liquid shall be kept at in the filter. The apparatus is set in working order by sucking the liquid into the tube *b*, so as to fill it. The liquid will continue to flow until its surface in the filter rises sufficiently to reach to and close the end of the tube *a*, cutting off the ingress of air into the bottle, and thus stopping the further flow, until, by the falling of the filtrate into the vessel placed to receive it, the liquid in the filter again sinks below the tube *a*, and allows the flow to be resumed until again stopped as before. (*See No.* 17, *Fig.* 6.)



3841. Chemical Washing. When precipitation takes place, the deposit requires to undergo edulcoration, or cleansing from the liquid from which it was precipitated. With heavy and bulky precipitates, this is done by repeated washing, and, after the deposit has again settled, decantation of the supernatant liquid (*see No.* 3847); but when the powder is light, and separates with less facility from the liquid, the washing is better performed by a continuous stream of water passing through a filter on which the precipitate has been previously collected. The apparatus employed for a self-feeding filter (*see No.* 3840) is admirably adapted for this purpose. *Lixiviation*, or the separation of soluble matter from an insoluble powder, can be performed in the same way. (*See Nos.* 14, 23, *and* 32.)

3842. Chemical Drying. In order to deprive chemical substances of water or moisture, the simplest means is evaporation. This may be performed either by merely exposure in open shallow vessels to the natural action of a dry atmosphere, called *spontaneous evaporation;* or by the application of heat, either directly or by a water-bath, &c. (*see No.* 12); this is not always advisable or necessary, as some substances undergo change by heat, and must be dried by other means. By enclosing the substance to be dried in a box or drying-chamber in which is placed an open vessel containing strong sulphuric acid or chloride of calcium, the strong affinity for water that these substances possess, keeps the air perfectly dry, and absorbs the moisture from it as fast as the water evaporates from the material which is being dried. The water of crystalline bodies is usually driven out by exposing the crystals in a capsule or evaporating dish to heat, only just sufficient being applied to effect the purpose. Some crystals part with their water of crystallization spontaneously by exposure to the air, crumbling into powder; such crystals are called *efflorescent*, to distinguish them from those *deliquescent* crystalline bodies which spontaneously liquefy or dissolve in their own water of crystallization. Others will yield their water in an artificially dried atmosphere, as above stated; while many have sufficient affinity for water to retain it until driven off by heat, more or less intense. Crystalline substances which have been deprived of the water of crystallization, that is, have undergone desiccation, are said to be *dry*.

3843. Decarbonization. This operation is performed on cast iron, to convert it into steel or soft iron. The articles to be decarbonized are packed in finely-powdered hematite, or native oxide of iron, to which iron filings are often added, and exposed for some time to a strong red heat, by which the excess of carbon is abstracted or burnt out. The process somewhat resembles annealing or cementation.

3844. Decoloration. The blanching or loss of the natural color of any substance. Syrups, and many animal, vegetable, and saline solutions, are decolored or whitened by agitation with animal charcoal, and subsequent subsidence or filtration. Many fluids rapidly lose their natural color by exposure to light, especially the direct rays of the sun. In this way, castor, nut, poppy, and several other oils are whitened. Fish oils are partially deodorized and decolored by filtration through animal charcoal. (*See No.* 3839.) By the joint action of light, air, and moisture, cottons and linens are commonly bleached. The peculiar way in which light produces this effect has never been satisfactorily explained. The decoloration of textile fabrics and solid bodies, generally, is called bleaching.

3845. Defecation. In chemistry, the separation of a liquid from its lees, dregs, or impurities. This is usually performed by subsidence and decantation, and is commonly applied to the purification of saline solutions, on the large scale, in preference to filtration, than which it is both more expeditious and inexpensive.

3846. Neutralization. The admixture of an alkali or base with an acid in such proportions that neither shall predominate. A neutral compound neither turns turmeric paper brown, nor litmus paper red. The term *saturation* is also applied to complete neutralization (*see No.* 27); but saturation has two distinct meanings; chemically, it denotes that a given alkali has been neutralized completely by an acid, or *vice versa*. Pharmaceutically, it implies that a given solvent is charged to its utmost capacity with an active ingredient; this point is, however, so difficult to determine, that the term is scarcely ever applied accurately.

3847. Edulcoration. The affusion of water on any substance for the purpose of removing the portion soluble in that fluid. Edulcoration is usually performed by agitating or triturating the article with water, and removing the latter after subsidence, by decantation' or filtration. It is the method commonly adopted to purify precipitates and other powders which are insoluble in water.

3848. Rectification. A second distillation of a fluid, for the purpose of rendering it purer. In rectifying alcohol containing water, the distillation is conducted at a temperature high enough to evaporate the alcohol and cause it to distill over into the receiver, but not high enough to boil the water, the greater part of which, therefore, remains behind in the body of the still. It is difficult to obtain an anhydrous product without employing some agent having a strong affinity for water.

3849. Calcination. The separation or expulsion, by heat, of volatile from fixed matter. By this means crystalline salts are obtained in a dry or anhydrous form, by depriving them of their water of crystallization; in this particular, the process is similar to *desiccation*. (*See No.* 12.) Calcination is also employed for the ignition of silica, &c., in order to render it more easily reducible to fragments or powder.

The operation of calcining is conducted on the small scale in platinum spoons or crucibles, and heat applied by the flame of a spirit lamp, or other appropriate means. When large quantities of matter are calcined, metal or earthenware crucibles and the heat of a furnace are employed. Charcoal is thus obtained from wood, bone-black from bones, &c.

3850. Ignition. The heating of a substance to redness. It is especially resorted to for the calcination of a substance at a high degree of heat. (*See No.* 3849.)

3851. To Bend Glass Tubes. Small glass tubes may be bent over the flame of a spirit lamp; for larger tubes, the heat of a blow-pipe flame is necessary. The tube should be heated to a dull red about an inch either way beyond the point of curvature, by revolving it in the flame; as soon as the glass begins to yield, bend the tube very gradually until curved as desired. Stopping one end of the tube, and blowing into the other while bending it, will prevent wrinkling or collapsing at the point of curvature. It requires some tact to bend a tube with an even curve and without collapsing its sides; and it is recommended by an experienced chemist to use a Bunsen burner, having the extremity flattened out so as to give a short and thin, but broad flame, something like the flame of an ordinary gas burner. The tube is placed in this flame and turned around until a good heat is given to the tube; it is then withdrawn from the flame and bent, when it does so with a perfect curve and no collapse on the sides of the tube. Of course this is only intended for the smaller tubes, but a tube of one-third of an inch and more can be thus bent very readily.

3852. To Find the Dry Weight of a Pulp or Moist Precipitate. Pulps or precipitates, such as the metallic colors, chrome yellow, white lead, &c., are of different consistence at the top from what they are at or near the bottom of the vessel in which they are contained; and the actual weight of the precipitate in the dry state can therefore not be arrived at by merely taking a sample from top or bottom, but, in most cases, only guessed at. When, however, the specific gravity of such a precipitate in its dry state is known, as well as that of the surrounding liquid, the operation of obtaining the accurate dry weight of the same while in pulp can be reduced to the simple manipulation of weighing it in a vessel. Find the weight of a vessel full of the pulp; then weigh the same vessel full of the same liquid that the pulp is moistened with, and note down the difference between the weights. Next divide this difference of weight by the difference between the specific gravities of the pulp and the liquid; lastly add this quotient to the difference of weight already noted down, and the sum will be the dry weight of the pulp.

Acids.

An acid in chemistry is any electro-negative compound, capable of combining in definite proportions with bases to form salts. Most of the liquid acids possess a sour taste, and redden litmus paper. The acids have been variously classed by different writers, as into *organic* and *inorganic; metallic* and *non-metallic; oxygen acids, hydrogen acids, and acids destitute of either of these elements;* the names being applied according to the kingdom of nature, or class of bodies to which the radical belonged, or after the element which was presumed to be the acidifying principle. Acids are in various forms; some are gaseous, as carbonic acid; some are liquid, as nitric and acetic acid; others are solid, as citric and oxalic acid; others again under peculiar conditions assume more than one of these forms. Acids, which are soluble or liquid, are corrosive, and more or less poisonous when concentrated. They change vegetable blues to red and neutralize the effects of alkalies on vegetable blues and yellows. Most of the acids are soluble in water in all proportions; they neutralize the alkalies, effervesce with the carbonates, and combine with the bases generally, forming compounds called *salts.* The methods for estimating the strength or neutralizing power of acids, as well as the strength of their solutions, will be found under ACIDIMETRY, No. 78. The names of the acids end either in *-ic* or *-ous;* the former being given to that containing the larger portion of the electro-negative element, or oxygen, and the latter to that containing the smaller quantity. As sulphur*ic* acid, an acid of sulphur, containing 3 atoms of oxygen; sulphur*ous* acid, another sulphur acid, containing only 2 atoms of oxygen. When a base forms more than 2 acid compounds with oxygen, the Greek preposition *hypo* is added to that containing the smaller portion, as hyposulphuric and hyposulphurous acids. The prepositions *per, hyper,* and the syllable *oxy* are also prefixed to the names of acids when it is intended to denote an increase of oxygen, as hypernitrous acid, perchloric acid, oxymuriatic acid, &c. The prefix *hydro* to the name of an acid denotes that the acid combination is with hydrogen, and not with oxygen. All the strong liquid acids should be kept in glass bottles, furnished with perfectly tight ground-glass stoppers; glass vessels should be used in measuring them, and they should be dispensed in stoppered vials. Fluoric acid must be kept in a bottle made of lead, silver, platinum, or pure gutta-percha, as it acts readily on glass. In the combination of acids with bases to form salts, distinctive terminations are employed to denote the kind of acid present. The name of a salt of an acid ending in *-ic,* terminates in *-ate;* thus, sulphate of soda, formed from sulphur*ic* acid and soda. The name of a salt of an acid ending in *-ous,* terminates in *-ite;* as sulphite of lime, formed from sulphur*ous* acid and lime. The names of compounds formed by the union of non-metallic elements, and certain other bodies, with the metals or with each other, terminate in *-ide* or *-uret;* thus, sulphide or sulphuret of silver, formed of silver and sulphur. (*Cooley.*) In accordance with the scope of this work it has been found advisable to omit a number of acids, both simple and compound, of limited practical use; the selection being confined to acids of more general utility and adaptation to practical purposes.

3854. Sulphuric Acid. This is a colorless, odorless acid, and highly corrosive liquid, formed by the union of 1 equivalent of sulphur and 3 of oxygen. It is immediately colored by contact with organic matter. It attracts water so rapidly from the atmosphere, when freely exposed to it, as to absorb $\frac{1}{3}$ its weight in 24 hours; and, under continued exposure, will absorb 6 times its weight. When 4 parts water are suddenly mixed with 1 part sulphuric acid, the temperature of the mixture rises to about 300° Fahr. Whilst 4 parts pounded ice mixed with 1 part acid, sinks the thermometer to some degrees below zero. Sulphuric acid boils and distills over at 620° Fahr., and freezes at about 20° below zero. The salts formed by the union of sulphuric acid with a base are called SULPHATES.

3855. To Obtain Commercial Sulphuric Acid. This is commonly called *oil of vitriol,* and has a specific gravity not less than 1.840, nor more than 1.845. It was first obtained by the distillation of green vitriol (sulphate of iron), but it is now made by bringing the fumes of sulphurous acid (*see No.* 3865) into contact with those evolved from a mixture of nitre and oil of vitriol, so that the former becomes oxidized at the expense of the latter. This process is conducted in a series of leaden chambers, having a little water on the floor, to absorb the acid, and so arranged as to prevent the loss of gas. As soon as the water is found to have acquired a specific gravity of 1.350 to 1.450, it is drawn off, and concentrated (*see No.* 8) in leaden boilers to a density of 1.659 to 1.700; after which it is further concentrated in green glass or platinum retorts until the specific gravity reaches 1.842 to 1.844. When cold, the clear acid is put into carboys (large globular bottles of green glass) packed securely with straw in strong wooden cases, the neck being left exposed for convenience in obtaining the acid without unpacking.

3856. Anhydrous Sulphuric Acid. Anhydrous or dry sulphuric acid is obtained by heating Nordhausen acid (*see No.* 3858) in a glass retort connected with a well-cooled receiver.

It is also prepared in the following manner: 2 parts strongest oil of vitriol are gradually added to 3 parts anhydrous phosphoric acid, contained in retort surrounded by a freezing mixture; when the compound has become brown, the retort is removed from the freezing bath and connected with a receiver which takes its place in the freezing mixture; a gentle heat is applied to the retort, when white vapors pass over and condense in the receiver under the form of beautiful silky crystals. The product equals in weight that of the phosphorus originally employed. The addition of a few drops of water to these crystals produces a dangerous explosion. They deliquesce rapidly and fume in the air; introduced into water, they hiss like red-hot iron. They melt at 66° Fahr., and boil at about 1050°, and do not redden dry litmus paper.

3857. Dilute Sulphuric Acid. The officinal strength of this acid, according to the U. S. Pharmacopœia, is thus obtained: Take 2 troy ounces sulphuric acid; add gradually to it 14 fluid ounces distilled water; filter through paper, and pass sufficient distilled water through the filter to make the diluted acid measure 1 pint. The specific gravity of this mixture is 1.082. The officinal strength of the British Pharmacopœia is somewhat greater; sufficient distilled water is added to 1350 grains sulphuric acid, so that, after it has been shaken and cooled down to

60° Fahr., it measures 1 imperial pint. The specific gravity of this is 1.094.

3858. Nordhausen Sulphuric Acid. This is also known as *fuming* sulphuric acid. It is a brown, oily liquid, which fumes in the air, is intensely corrosive, and has a specific gravity of about 1.900, and is chiefly used for dissolving indigo. It is prepared by distilling calcined sulphate of iron (green vitriol) in an earthen retort.

3859. Table Showing the Percentage of Liquid and Dry Sulphuric Acid in Dilute Acid at Different Densities.

Liquid.	Sp. Gr.	Dry.	Liquid.	Sp. Gr.	Dry.
100	1.8485	81.54	50	1.3884	40.77
99	1.8475	80.72	49	1.3788	39.95
98	1.8460	79.90	48	1.3697	39.14
97	1.8439	79.09	47	1.3612	38.32
96	1.8410	78.28	46	1.3530	37.51
95	1.8376	77.46	45	1.3440	36.69
94	1.8336	76.65	44	1.3345	35.88
93	1.8290	75.83	43	1.3255	35.06
92	1.8233	75.02	42	1.3165	34.25
91	1.8179	74.20	41	1.3080	33.43
90	1.8115	73.39	40	1.2999	32.61
89	1.8043	72.57	39	1.2913	31.80
88	1.7962	71.75	38	1.2826	30.98
87	1.7870	70.94	37	1.2740	30.17
86	1.7774	70.12	36	1.2654	29.35
85	1.7673	69.31	35	1.2572	28.54
84	1.7570	68.49	34	1.2490	27.72
83	1.7465	67.68	33	1.2409	26.91
82	1.7360	66.86	32	1.2334	26.09
81	1.7245	66.05	31	1.2260	25.28
80	1.7120	65.23	30	1.2184	24.46
79	1.6993	64.42	29	1.2108	23.65
78	1.6870	63.60	28	1.2032	22.83
77	1.6750	62.78	27	1.1956	22.01
76	1.6630	61.97	26	1.1876	21.20
75	1.6520	61.15	25	1.1792	20.38
74	1.6415	60.34	24	1.1706	19.57
73	1.6321	59.52	23	1.1626	18.75
72	1.6204	58.71	22	1.1549	17.94
71	1.6090	57.89	21	1.1480	17.12
70	1.5975	57.08	20	1.1410	16.31
69	1.5868	56.26	19	1.1330	15.49
68	1.5760	55.45	18	1.1246	14.68
67	1.5648	54.63	17	1.1165	13.86
66	1.5503	53.82	16	1.1090	13.05
65	1.5390	53.00	15	1.1019	12.23
64	1.5280	52.18	14	1.0953	11.60
63	1.5170	51.37	13	1.0887	10.41
62	1.5066	50.55	12	1.0809	9.78
61	1.4960	49.74	11	1.0743	8.97
60	1.4860	48.92	10	1.0682	8.15
59	1.4760	48.11	9	1.0614	7.34
58	1.4660	47.29	8	1.0544	6.52
57	1.4560	46.48	7	1.0477	5.71
56	1.4460	45.66	6	1.0405	4.89
55	1.4360	44.85	5	1.0336	4.08
54	1.4265	44.03	4	1.0268	3.26
53	1.4170	43.22	3	1.0206	2.446
52	1.4073	42.40	2	1.0140	1.63
51	1.3977	41,58	1	1.0074	0.8154

3860. To Purify Oil of Vitriol. Commercial sulphuric acid frequently contains *nitrous acid*, *arsenic*, and *saline matter*. These impurities must be removed in order to obtain the acid in any high degree of purity.

Nitrous acid is removed by adding about 1½ grains sugar to each fluid ounce of the sulphuric acid, heated to nearly its boiling point, and continuing the heat until the dark color at first produced disappears, when it should be distilled. Another method is by adding ⅛ to ½ of 1 per cent. of sulphate of ammonia to the acid, and heating to ebullition for a few minutes. In this way the most impure acid may be rendered absolutely free from nitric acid and nitrous oxide.

Arsenic can be got rid of by adding a little sulphuret of barium, or of copper foil, to the acid, agitating the mixture well, and, after repose, decanting or distilling it.

Saline matter may be removed by simply redistilling (*rectification.*) The distillation is best conducted on the small scale, in a glass retort containing a few platinum chips, heated by a sand-bath or gas flame, rejecting the first ½ fluid ounce that comes over.

3861. Test for Nitric Acid in Sulphuric Acid. Place in a watch glass a small portion pure and concentrated sulphuric acid at a density of 1.84; then pour, drop by drop, half the quantity of a solution of sulphate of aniline, prepared by mixing commercial aniline with diluted sulphuric acid. A glass rod is dipped in the liquid to be tested, and then stirred in the contents of the watch glass; from time to time the experimenter should blow slowly on the agitated liquid; if the liquid thus stirred contains traces of nitric acid, circular lines of a deep red are soon visible, coloring the whole liquid to a pink. On adding a very small quantity of nitric acid to the mixture, the liquid becomes of a carmine color; the addition of a single drop of very dilute nitric acid renders the liquid a deep red, and afterwards a dead red.

3862. To Remove Nitric Acid from Sulphuric Acid. Diluted sulphuric acid may be deprived of any small quantity of nitric acid it may contain, by shaking it up for a few minutes with a little powdered (freshly burned) charcoal, and afterwards filtering it. This will not answer for concentrated sulphuric acid; nitric acid is separated from it with great difficulty, and only by very protracted methods.

3863. To Decolorize Sulphuric Acid. Acid which has become brown by exposure may be decolorized by heating it gently; the carbon of the organic substances is thus converted into carbonic acid.

3864. Sulphurous Acid. This acid is used to bleach silks, woolens, &c., (*see No.* 1716), and to remove vegetable stains and iron-moulds from linen. For these purposes it is prepared from sawdust, or any other refuse carbonaceous matter. The salts formed by the combination of sulphurous acid with a base are called SULPHITES. (*See Nos.* 1717 *and* 1718.)

3865. To Obtain Sulphurous Acid. In the gaseous form this acid is freely evolved by burning sulphur in air or in dry oxygen. It is also given off during the digestion of metals in hot sulphuric acid. When charcoal, wood, or cork chips, or sawdust are digested in hot sulphuric acid, a mixture of sulphurous and carbonic acids is obtained, which is used for bleaching and cleansing purposes.

3866. Pure Gaseous Sulphurous Acid. This is evolved during the action of sulphuric acid on mercury or clippings of copper. It is also obtained pure by heating in a glass retort, a mixture of 100 parts black oxide of manganese, and 12 or 14 parts sulphur. The gas evolved should be collected in a receiver over mercury.

3867. Sulphurous Acid Solution. The gas obtained according to the last method is to be passed through water, which is capable of dissolving or absorbing 30 times its bulk of the gas. To avoid waste in preparing the solution, the unabsorbed gas which escapes from the water is usually again passed through water, and the same arrangement repeated through a series of vessels of water so long as any gas escapes undissolved.

3868. Pure Sulphurous Acid. In order to prepare sulphurous acid from sulphuric acid and charcoal, it is better to employ an acid of .74 per cent., or 1.825 specific gravity. If we take a stronger acid, a part of it is entirely deoxidized to sulphur, and if weaker acid be employed, sulphuretted hydrogen is evolved. To obtain absolutely pure sulphurous acid, it is well to put sulphite of lead and coarse charcoal in the wash bottle. With these precautions, it is possible to obtain pure sulphurous acid from sulphuric acid and charcoal.

3869. Pure Liquid Sulphurous Acid. This can only be obtained by passing the pure dry gas through a glass tube surrounded by a powerful freezing mixture. The specific gravity of the pure liquid gas is 1.45; its boiling point is 14° Fahr., and causes intense cold by its evaporation.

3870. Hydrosulphuric Acid, also Called Sulphuretted Hydrogen. When sulphur acts upon paraffine at a temperature a little above the melting point of sulphur, hydrosulphuric acid gas is evolved in large quantities, and this method may be advantageously used for its generation in the laboratory. A flask, holding about a pound of the material, is fitted with a tube bent at right angles, about ½ inch bore and 12 to 18 inches long, containing cotton wool, and to this is attached the small tube for precipitation. The production of gas may be stopped by removing the heat. Heavy paraffine oil, stearic acid, or suet, may be used as a substitute for paraffine.

3871. Nitro-Sulphuric Acid. Dissolve 1 part nitre in 9 parts sulphuric acid. This is used to separate the silver from the copper and solder of old plated goods. At about 200° Fahr. it readily dissolves silver, but scarcely acts on copper, lead, or tin, unless diluted, or assisted by a much higher temperature.

3872. Nitric Acid. There are five compounds of nitrogen and oxygen. The union of 1 equivalent of nitrogen with 1 of oxygen produces nitrous oxide, or *laughing gas;* with 2 oxygen, nitric oxide; with 3 oxygen, nitrous acid; with 4 oxygen, hyponitric acid; and with 5 equivalents of oxygen, nitric acid. Pure liquid nitric acid is colorless, highly corrosive, and possesses powerful acid properties. It is employed in assaying, to dye silk and woolens yellow, and to form various salts. In medicine, it is used as a caustic, &c. The officinal strength of nitric acid of the U. S. and British pharmacopœias has a specific gravity of 1.42, and boils at 250° Fahr. Nitric acid of less density than 1.42 parts with water and becomes stronger at lower temperatures; but acid of higher specific gravity is weakened by exposure to heat. It freezes when exposed to extreme cold. It rapidly oxidizes the metals, and unites with them and the other bases, forming salts called NITRATES. Two strengths of this acid occur in the arts, known as double and single aqua-fortis. Double aqua-fortis has usually a specific gravity of 1.36, and single, or ordinary aqua-fortis 1.22. Both are frequently sold at lower strengths. This can easily be ascertained by acidimetry. (*See No.* 78.)

3873. To Obtain Nitric Acid. The usual method adopted for obtaining this acid is to add to nitrate of potassa in coarse powder, contained in a glass retort, an equal weight of strong sulphuric acid, poured in through a funnel, so as not to wet the neck of the retort. The materials should not exceed two-thirds of the capacity of the retort. A moderate heat is at first applied, increasing as the materials begin to thicken. Red vapors will at first arise and pass over into the receiver; these will disappear in the course of the distillation, but subsequently renewed, showing that the process is completed. The pale yellow acid thus obtained may be rendered colorless, if desired, by heating it gently in a retort.

3874. To Purify Nitric Acid. The nitric acid of commerce frequently contains chlorine, muriatic and sulphuric acids, and sometimes iodine, from which it may be purified by the addition of a little nitrate of silver, as long as it produces any cloudiness, and, after repose, decanting the clear acid, and rectifying it at a heat under 212° Fahr. A perfectly colorless product may be obtained, by introducing a small portion of pure black oxide of manganese into the retort. Nitric acid may also be purified by rectification at a gentle heat, rejecting the first liquid that comes over, receiving the middle portion as genuine acid, and leaving a residuum in the retort. Another method is to agitate it with a little red-lead before rectification.

3875. Tests for Nitric Acid. It stains the skin yellow. When mixed with a little muriatic acid or sal-ammoniac, it acquires the power of dissolving gold leaf. When mixed with dilute sulphuric acid, and poured on a few fragments of zinc or iron in a tube, the evolved gas burns with a greenish white flame. Substitute alcohol for zinc in the last test. Morphia, brucia, and strychnia give it a red color, which is heightened by ammonia in excess. When placed in a tube, and a solution of protosulphate of iron cautiously added, a dark color is developed at the line of junction, which is distinctly visible when only $\frac{1}{24000}$ part of nitric acid is present. When mixed with a weak solution of sulphate of indigo, and heated, the color is destroyed.

3876. Dilute Nitric Acid. Mix 3 troy ounces nitric acid specific gravity 1.42 in a glass vessel with sufficient distilled water to make the dilute acid measure 1 pint. The specific gravity of officinal dilute nitric acid is 1.068, U. S. Dis.

3877. Fuming Nitric Acid. The red fuming nitrous or nitric acid of commerce is simply nitric acid loaded with nitrous or hyponitric acid. It may be thus prepared: Put into an iron or stoneware pot, nitre or nitrate of soda, add rather more than half its weight of strong sulphuric acid, and lute on a stoneware head. The vapor is conducted into a series of two-necked stoneware vessels, containing each ⅙ of their capacity of water. The acid is usually obtained of the density of about 1.45. It is colored with nitrous acid gas, forming what is commonly, but improperly, termed nitrous acid. By gently heating the colored acid in a retort, the nitrous acid is driven off, and the acid remains nearly colorless, usually of the density of 1.38 to 1.42.

3878. Ure's Table of Percentage of Nitric Acid. This table is useful for finding the strength of dilute acids.

Specific Gravity.	Liq. Acid in 100.	Dry Acid in 100.	Specific Gravity.	Liq. Acid in 100.	Dry Acid in 100.
1.5000	100	79.700	1.2947	50	39.850
1.4980	99	78.903	1.2887	49	39.053
1.4960	98	78.106	1.2826	48	38.256
1.4940	97	77.309	1.2765	47	37.459
1.4910	96	76.512	1.2705	46	36.662
1.4880	95	75.715	1.2644	45	35.865
1.4850	94	74.918	1.2583	44	35.068
1.4820	93	74.121	1.2523	43	34.271
1.4790	92	73.324	1.2462	42	33.474
1.4760	91	72.527	1.2402	41	32.677
1.4730	90	71.730	1.2341	40	31.880
1.4700	89	70.933	1.2277	39	31.083
1.4670	88	70.136	1.2212	38	30.286
1.4640	87	69.339	1.2148	37	29.489
1.4600	86	68.542	1.2084	36	28.692
1.4570	85	67.745	1.2019	35	27.895
1.4530	84	66.948	1.1958	34	27.098
1.4500	83	66.155	1.1895	33	26.301
1.4460	82	65.354	1.1833	32	25.504
1.4424	81	64.557	1.1770	31	24.707
1.4385	80	63.760	1.1709	30	23.900
1.4346	79	62.963	1.1648	29	23.113
1.4306	78	62.166	1.1587	28	22.316
1.4269	77	61.369	1.1526	27	21.519
1.4228	76	60.572	1.1465	26	20.722
1.4189	75	59.755	1.1403	25	19.925
1.4147	74	58.978	1.1345	24	19.128
1.4107	73	58.181	1.1286	23	18.331
1.4065	72	57.384	1.1227	22	17.534
1.4023	71	56.587	1.1168	21	16.737
1.3978	70	55.790	1.1109	20	15.940
1.3945	69	54.993	1.1051	19	15.143
1.3882	68	54.196	1.0993	18	14.346
1.3833	67	53.399	1.0935	17	13.549
1.3783	66	52.602	1.0878	16	12.752
1.3732	65	51.805	1.0821	15	11.955
1.3681	64	51.068	1.0764	14	11.158
1.3630	63	50.211	1.0708	13	10.361
1.3579	62	49.414	1.0651	12	9.564
1.3529	61	48.617	1.0595	11	8.767
1.3477	60	47.820	1.0540	10	7.970
1.3427	59	47.023	1.0485	9	7.173
1.3376	58	46.226	1.0430	8	6.376
1.3323	57	45.429	1.0375	7	5.579
1.3270	56	44.632	1.0320	6	4.782
1.3216	55	43.835	1.0267	5	3.985
1.3163	54	43.038	1.0212	4	3.188
1.3110	53	42.241	1.0159	3	2.391
1.3056	52	41.444	1.0106	2	1.594
1.3001	51	40.647	1.0053	1	0.797

3879. Nitro-Muriatic Acid. Aqua regia. This is used in the arts, chiefly as a solvent for gold. By the mutual action of nitric and muriatic acids a compound of chlorine, nitrogen, and oxygen is formed. The best proportions and strength of the acids are variously stated. Colorless nitric acid must be used. Elkington employs 21 parts of nitric acid, specific gravity 1.45; 17 parts of muriatic acid 1.15 specific gravity; and 14 parts of water. This dissolves 5 parts of gold. (*See No.* 3588.) According to Cooley this acid is prepared by mixing 1 part by measure nitric acid and 2 parts hydrochloric acid. The mixture should be kept in a bottle in a cold and dark place. (*See No.* 3193.) With a base, this compound acid forms a NITRO-MURIATE.

3880. Dyer's Aqua-Fortis. Another mixture of nitric and hydrochloric acids, known as Dyer's aqua-fortis, is used by dyers, as it dissolves tin without oxidizing it. Mix 10 pounds colorless nitric acid, specific gravity 1.17, with 1 pound hydrochloric acid 1.19.

3881. Dilute Nitro-Muriatic Acid. Mix 1½ troy ounces nitric acid, and 2½ troy ounces muriatic acid in a pint bottle. Shake occasionally during 24 hours, and add distilled water to make up to 1 pint. Keep in a cool place, protected from the light. (*U. S. Ph.*)

3882. Muriatic or Hydrochloric Acid. Pure muriatic acid is a colorless invisible gas, having a pungent odor and an acid taste, and fuming on coming into contact with air. It is irrespirable and uninflammable. Its specific gravity is 1.2695. Under a pressure of 40 atmospheres it is liquid. Water at 40° Fahr. absorbs 480 times its volume of this gas, and acquires the specific gravity 1.2109. One cubic inch of water at 69° Fahr. absorbs 418 cubic inches, and the specific gravity becomes 1.1958. The aqueous solution of the gas constitutes the liquid form of the acid. The combinations of muriatic acid with a base are MURIATES, or HYDROCHLORATES.

3883. To Obtain Muriatic Acid. The acid solution in water is thus obtained: Introduce 48 ounces (avoirdupois) dried chloride of sodium into a flask capable of containing an imperial gallon. Pour 44 fluid ounces sulphuric acid slowly into 32 fluid ounces water; and, when cool, add the mixture to the chloride of sodium in the flask. Connect the flask, by corks and a glass tube, with a three-necked wash-bottle, furnished with a safety tube, and containing 4 ounces water. Apply heat to the flask, conduct the disengaged gas through the wash-bottle, and thence, by means of a glass tube, into another bottle containing 50 fluid ounces distilled water, the end of the tube dipping about ½ inch below the surface. Continue the process until the product measures 66 fluid ounces, or till the liquid has acquired a specific gravity of 1.16. The bottle must be kept cool during the process.

The muriatic acid of commerce is now chiefly obtained from the manufacturers of carbonate of soda, who procure it as a secondary product. When, however, it is directly prepared from sea-salt, an iron or stoneware boiler, set in brickwork over an open fire, furnished with a stoneware head, and connected with a series of capacious double-necked stoneware bottles, usually constitutes the distillatory and condensing apparatus.

3884. Gregory's Method of Obtaining Pure Muriatic Acid. Put into a matrass 6 parts, by weight, of purified salt, and 10 ounces oil of vitriol previously diluted with 4 of water, and cooled. Fix in the matrass a tube twice bent at right angles and having a bulb blown on the descending limb. Into a bottle surrounded with ice and water introduce distilled water equal in weight to the salt employed, and let the bent tube dip ⅛ of an inch into the water. Apply a gentle heat of a sand-bath to the matrass as long as acid comes over. In about 2 hours the operation will be finished. The water is increased ⅜ in bulk, and converted into hydrochloric acid of 1.14 or 1.15 specific gravity. To procure it of 1.21 specific gravity, employ part of this acid during the first half of a similar operation, and it will be speedily saturated. Phillips says a perfectly colorless acid may be obtained from the commercial sulphuric acid and common salt.

3885. Dilute Muriatic Acid. Mix 4 troy ounces muriatic acid with sufficient distilled water to make a pint. The specific gravity of the diluted acid is 1.038. (*U. S. Ph.*)

3886. Ure's Table of Percentage of Chlorine and Muriatic Acid Gas in Liquid Muriatic Acid.

Acid of 1.20 in 100.	Specific Gravity.	Chlorine	Muriatic Gas.
100	1.2000	39.675	40.777
99	1.1982	39.278	40.369
98	1.1964	38.882	39.961
97	1.1946	38.485	39.554
96	1.1928	38.089	39.146
95	1.1910	37.692	38.738
94	1.1893	37.296	38.330
93	1.1875	36.900	37.923
92	1.1857	36.503	37.516
91	1.1846	36.107	37.108
90	1.1822	35.707	36.700
89	1.1802	35.310	36.292
88	1.1782	34.913	35.884
87	1.1762	34.517	35.476
86	1.1741	34.121	35.068
85	1.1721	33.724	34.660
84	1.1701	33.328	34.252
83	1.1681	32.931	33.845
82	1.1661	32.535	33.437
81	1.1641	32.136	33.029
80	1.1620	31.746	32.621
79	1.1599	31.343	32.213
78	1.1578	30.946	31.805
77	1.1557	30.550	31.398
76	1.1536	30.153	30.990
75	1.1515	29.755	30.582
74	1.1494	29.361	30.174
73	1.1473	28.964	29.767
72	1.1452	28.567	29.359
71	1.1431	28.171	28.951
70	1.1410	27.772	28.544
69	1.1389	27.376	28.136
68	1.1369	26.979	27.728
67	1.1349	26.583	27.321
66	1.1328	26.186	26.913
65	1.1308	25.789	26.505
64	1.1287	25.392	26.098
63	1.1267	24.996	25.690
62	1.1247	24.599	25.282
61	1.1226	24.202	24.874
60	1.1206	23.805	24.466
59	1.1185	23.408	24.058
58	1.1164	23.012	23.650
57	1.1143	22.615	23.242
56	1.1123	22.218	22.834
55	1.1102	21.822	22.426
54	1.1082	21.425	22.019
53	1.1061	21.028	21.611
52	1.1041	20.632	21.203
51	1.1020	20.235	20.796
50	1.1000	19.837	20.388
49	1.0980	19.440	19.980
48	1.0960	19.044	19.572
47	1.0939	18.647	19.165
46	1.0919	18.250	18.757
45	1.0899	17.854	18.349
44	1.0879	17.457	17.941
43	1.0859	17.060	17.534
42	1.0838	16.664	17.126
41	1.0818	16.267	16.718
40	1.0798	15.870	16.310
39	1.0778	15.474	15.902
38	1·0758	15.077	15.494
37	1.0738	14.680	15.087
36	1.0718	14.284	14.679
35	1.0697	13.887	14.271
34	1.0677	13.490	13.863
33	1.0657	13.094	13.456
32	1.0637	12.697	13.049
31	1.0617	12.300	12.641
30	1.0597	11.903	12.233
29	1.0577	11.506	11.825
28	1.0557	11.109	11.418
27	1.0537	10.712	11.010
26	1.0517	10.316	10.602
25	1.0497	9.919	10.194
24	1.0477	9.522	9.786
23	1.0457	9.126	9.379
22	1.0437	8.729	8.971
21	1.0417	8.332	8.563
20	1.0397	7.935	8.155
19	1.0377	7.538	7.747
18	1.0357	7.141	7.340
17	1.0337	6.745	6.932
16	1.0318	6.348	6.524
15	1.0298	5.951	6.116
14	1.0279	5.554	5.709
13	1.0259	5.158	5.301
12	1.0239	4.762	4.893
11	1.0220	4.365	4.486
10	1.0200	3.968	4.078
9	1.0180	3.571	3.670
8	1.0160	3.174	3.262
7	1.0140	2.778	2.854
6	1.0120	2.381	2.447
5	1.0100	1.984	2.039
4	1.0080	1.588	1.631
3	1.0060	1.191	1.224
2	1.0040	0.795	0.816
1	1.0020	0.397	0.408

3887. Tests for Muriatic Acid. When a glass rod, dipped in liquor of ammonia, is held near it, it gives off white fumes. With nitrate of silver it gives a white, cloudy precipitate, insoluble in nitric acid, freely soluble in liquor of ammonia, and blackened by exposure to the light.

3888. To Purify Muriatic Acid. Commercial muriatic acid may be purified by diluting it with an equal weight of water, gently heating it in a retort, and receiving the evolved gas into a fresh quantity of pure water. Iodine and arsenic may be removed by agitating it for a few minutes with some small pieces of bright copper foil previously to rectification.

3889. Acetic Acid. This is the well-known acid principle of vinegar. It is one of the common products of fermentation, of the oxygenation of alcohol, and of the destructive distillation of wood and other vegetable matter. The officinal strength of acetic acid adopted by the U. S. Pharmacopœia has a specific gravity of 1.047. Special methods for testing the strength of acetic acid are given under Acetimetry, No 69. With bases this acid forms ACETATES.

Commercial acetic acid is principally manufactured on the large scale from acetate of soda, which yields a sufficiently strong and pure acid for commercial purposes, without the trouble of rectification. In this process, shallow copper vessels formed without rivets or solder in those parts exposed to the action of the acid, are employed for the purpose of the distillation. A coil of drawn copper pipe, heated by steam, having a pressure of 30 to 35 pounds to the inch, traverses the bottom of the apparatus. The refrigeratory consists of well cooled earthenware vessels, and the adopter or pipe connecting the still with the receivers is also of the same materials. Stills of earthenware are also frequently employed, and even worms and condensers of silver are sometimes used. The crystalline acetate of soda is placed in the still, and 35 to 36 parts of strong oil of vitriol are added to every 100 parts of the acetate of soda, and the whole stirred together with a wooden spatula. The head of the still is then luted on and the distillation commenced. This produces an acid of a specific gravity of about 1.050, and, after being agitated with a little animal charcoal, and passed through a prepared muslin filter, is ready for sale. Some manufacturers add a little acetic ether to it. By this process 4 pounds of acetic acid of the strength above mentioned is obtained for every 3 pounds of the acetate of soda employed. (*See No.* 1741.)

3890. Dilute Acetic Acid. The U. S. Pharmacopæia directs 1 pint acetic acid to be mixed with 7 pints distilled water, producing an acid of specific gravity 1.006; 100 grains of dilute acetic acid saturate 7.6 grains bicarbonate of potassa.

3891. To Obtain Pure Glacial or Hydrated Acetic Acid. Place 30 parts dry and finely powdered pure acetate of soda in a capacious retort, and pour on it 97 parts pure sulphuric acid. The heat developed by the action of the ingredients will cause one-eighth of the acetic acid to pass over. The retort may then be placed in a sand bath until the contents become quite liquid. The product, carefully rectified, yields 2 parts of pure acid containing only 20 per cent. of water. By exposing the latter portion, which comes over in a closed vessel, to a temperature below 40° Fahr., crystals of hydrated (glacial) acetic acid will be deposited. The liquid portion being then poured off, the crystals are again melted and re-crystallized by cooling. These last crystals, separated from the liquid, are perfectly pure.

3892. To Obtain Glacial or Hydrated Acetic Acid Without Distillation. The acid may also be obtained without resorting to distillation, thus: Place 100 parts powdered acetate of soda (pure commercial) in a hard-glazed stoneware or glass pan; pour 35 or 36 parts concentrated sulphuric acid gradually into the pan, so that the acid may flow under the powder, and as little heat as possible be generated by the operation. In furtherance of this necessary end, the process is best conducted in a cool apartment, and the pan kept well cooled. The whole must now be covered and allowed to stand for some hours, when crystalline grains of sulphate of soda will be found covering the inside of the vessel, and hydrated acetic acid, partly liquid and partly in crystals, in the upper portion. The temperature must then be raised just sufficiently to liquefy the crystals of acetic acid, the fluid poured off, and a very small quantity of pure acetate of lime added gradually, until it yields no trace of sulphuric acid on evaporation. After repose it may be decanted for use.

3893. To Obtain Pure Acetic Acid. Triturate together 10 parts crystallized neutral acetate of lead, and 3 parts effloresced (dry) sulphate of soda; mix together 2½ parts each of sulphuric acid and water, and, when cold, pour it on the acetate and sulphate, previously placed in a retort; then distill to dryness in a sand bath. The acid that comes over in the distillation by this process is very pure, and may be used as a test acid for chemical analyses.

3894. To Obtain Anhydrous Acetic Acid. This is acetic acid free from water, as it exists in dry acetates. Mix, in a glass retort, well-fused acetate of potassa with half its weight of chloride of benzoyle; apply a gentle heat, collect the liquid that distills over, and rectify it carefully. Hot water added to this resolves it into hydrated or glacial acetic acid.

3895. Camphorated Acetic Acid. Pulverize 1 ounce camphor in 1 fluid drachm rectified spirit, and dissolve in 10 fluid ounces strong acetic acid. This is fragrant and refreshing, and used as an embrocation in rheumatism and neuralgia, and as a fumigation in fever, &c.

3896. To Obtain Strong Acetic Acid from Vinegar. Expose the vinegar to the action of a freezing mixture, or place in the air in very cold weather; the water separates and becomes ice, and the strong acid remaining fluid may be drained from it. (*See No.* 1749.)

3897. Mohr's Table of the Specific Gravity of Acetic Acid at Various strengths. The following table, drawn up by M. Mohr, exhibits the specific gravity of acetic acid of almost every strength.

Per cent. of Glacial Acid.	Sp. Gr.	Per cent. of Glacial Acid.	Sp. Gr.	Per cent. of Glacial Acid.	Sp. Gr.
100	1.0635	67	1.069	34	1.045
99	1.0635	66	1.069	33	1.044
98	1.067	65	1.068	32	1.0424
97	1.0680	64	1.068	31	1.041
96	1.069	63	1.068	30	1.040
95	1.070	62	1.067	29	1.039
94	1.0706	61	1.067	28	1.038
93	1.0708	60	1.067	27	1.036
92	1.0716	59	1.066	26	1.035
91	1.0721	58	1.066	25	1.034
90	1.0730	57	1.065	24	1.033
89	1.0730	56	1.064	23	1.032
88	1.0730	55	1.064	22	1.031
87	1.0730	54	1.063	21	1.029
86	1.0730	53	1.063	20	1.027
85	1.0730	52	1.062	19	1.026
84	1.0730	51	1.061	18	1.025
83	1.0730	50	1.060	17	1.024
82	1.0730	49	1.059	16	1.023
81	1.0732	48	1.058	15	1.022
80	1.0735	47	1.056	14	1.020
79	1.0732	46	1.055	13	1.018
78	1.0732	45	1.055	12	1.017
77	1.073	44	1.054	11	1.016
76	1.072	43	1.053	10	1.015
75	1.072	42	1.052	9	1.013
74	1.072	41	1.0515	8	1.012
73	1.071	40	1.0513	7	1.010
72	1.071	39	1.050	6	1.008
71	1.071	38	1.049	5	1.0067
70	1.070	37	1.048	4	1.0065
69	1.070	36	1.047	3	1.004
68	1.070	35	1.046	2	1.002
				1	1.001

3898. To Concentrate Acetic Acid. Acid containing 20 per cent. of water may be deprived of a good deal of its superfluous water by standing over dry sulphate of soda. It may then be used either with or without distillation. Acetic acid of ordinary strength may be concentrated to any degree of rectification once or oftener from dry acetate of potassa or soda, rejecting the first and last portions that come over. The same acetate may be used repeatedly. The heat employed must not exceed 500° to 570° Fahr. Pure hydrated acetic acid liquefies above 62° Fahr.; at 50° to 55° it crystallizes in brilliant, colorless, transparent needles and plates; at 40° it is a crystalline solid. Free acetic acid reddens litmus paper, and may be recognized by its odor and volatility.

3899. Tests for the Purity of Acetic Acid. By heat it escapes *entirely* in vapor. Either nitrate of silver or chloride of barium being added to it, will produce no precipitate. When a thin plate of silver is digested in it, and hydrochloric acid subsequently dropped in, no precipitate is formed. Its color is unchanged by the addition of hydrosulphuric acid, or ammonia, or by ferrocyanide of potassium added after the ammonia. The presence of sulphuric acid is indicated by a white precipitate being formed on the addition of a little peroxide of lead.

3900. Oxalic Acid. This consists of colorless crystals, possessing considerable volatility, and a strong, sour taste; when exposed to a very dry atmosphere they effloresce slightly. Oxalic acid sublimes at 180° Fahr., and melts at 280°; is soluble in about nine times its weight of cold, and in its own weight of boiling water; soluble also, but in a less degree, in alcohol. It has a strong affinity for lime, and is therefore a good test for its presence, by yielding a precipitate insoluble in excess of the acid. With the bases, oxalic acid forms OXALATES.

3901. To Obtain Oxalic Acid. Liebig proposes: Nitric acid (specific gravity 1.42), 5 parts; water, 10 parts; mix, add sugar, or preferably potato starch, 1 part, and digest by a gentle heat as long as gaseous products are evolved; evaporate and crystallize, dry the crystals, redissolve in the smallest possible quantity of boiling water, and crystallize; 12 parts of potato starch yield 5 of acid. The mother water, treated with more nitric acid, and again warmed, will yield a second crop of crystals; and this should be repeated till the solution is exhausted.

Schlesinger gives the following method: Sugar 4 parts (dried at 257° Fahr.); nitric acid (specific gravity 1.38) 33 parts; the mixture, as soon as the evolution of gas ceases, is to be boiled down to one-sixth its original volume, and allowed to crystallize. The whole process may be executed in 2 hours, and yields of beautifully crystallized oxalic acid from 56 to 60 per cent. of the sugar employed.

On the large scale, the first part of the process is usually conducted in salt-glazed stoneware pipkins, about two-thirds filled and set in a water-bath; but on the small scale a glass retort or capsule may be used. The evaporation should be preferably conducted by steam. The evolved nitrous vapors are usually allowed to escape, but if conveyed into a chamber filled with cold damp air, and containing a little water, they will absorb oxygen, and be recondensed into fuming nitric acid. In England an equivalent proportion of molasses is usually substituted for sugar. Another process consists in first converting potato fecula into grape sugar with sulphuric acid, and then decomposing the sugar thus obtained by nitric acid, in the usual way. Dr. Ure recommends the use of a little sulphuric acid along with the nitric acid, which, he says, contributes to increase the product; 15 pounds of sugar yielding fully 17 pounds of crystallized oxalic acid.

3902. Dale's Process for Obtaining Oxalic Acid. At present much of the oxalic acid of commerce is obtained by heating sawdust with a mixture of 2 parts caustic soda with 1 part caustic potassa. A watery solution of the mixed alkalies is evaporated to specific gravity 1.35, and then mixed with sawdust to a paste. This is heated on iron plates to 400° Fahr., and kept at that temperature for 1 or 2 hours, with constant stirring; the heat is continued until the mass is quite dry, but not charred. It now contains 28 to 30 per cent. of oxalic acid combined with the alkalies. By washing the powder on a filter with a solution of carbonate of soda, all traces of potassa are washed out. The oxalate of soda is converted, by heated milk of lime, into oxalate of lime, and the resulting oxalate of lime is treated with sulphuric acid, leaving a solution of oxalic acid ready to be evaporated into crystals. Two pounds of sawdust yield 1 pound oxalic acid.

3903. Chemically Pure Oxalic Acid. Chemically pure oxalic acid is best prepared by precipitating a solution of binoxalate of potash with acetate of lead, washing the precipitate with water, and decomposing it, while still moist, with dilute sulphuric acid or sulphuretted hydrogen. Filter and evaporate gently, so that crystals may form as it cools.

3904. To Distinguish Oxalic Acid from Epsom Salts. Oxalic acid has occasionally been mistaken for Epsom salts, with fatal results. They may be easily distinguished. Epsom salts taste extremely *bitter* and *nauseous;* oxalic acid tastes extremely *sour.* It is safer to taste a weak solution in applying this test. Epsom salts, dissolved in water and mixed with carbonate of soda, or carbonate of potash, *turn milky*, and, after a time, a white sediment subsides; oxalic acid, mixed with carbonate of soda or carbonate of potash, *effervesces*, and the liquid, in a few seconds, becomes transparent.

3905. Gallic Acid. When pure, gallic acid forms small, feathery, and nearly colorless crystals, which have a beautiful silky lustre. Commercial gallic acid has usually a pale yellow color, soluble in both water and alcohol. Its aqueous solution decomposes by exposure to the air. It blackens the salts of iron. Dissolved in hot oil of vitriol, it forms a deep, rich, red solution, which, when thrown into water, drops the gallic acid, deprived of some of its water. Gallic acid forms GALLATES with the bases.

3906. To Obtain Gallic Acid. Mix 36 troy ounces nut-gall, in fine powder, with sufficient distilled water to make a thin paste; expose the mixture to the air in a shallow glass or porcelain vessel, in a warm place, for a month, occasionally stirring with a glass rod, and adding sufficient distilled water to preserve the original consistence. Then press out the water, boil the residue in 8 pints distilled water for a few minutes, and filter while hot through purified animal charcoal. (*See No.* 1752). Set aside to crystallize, and dry the crystals on bibulous paper. If not sufficiently free from color, dissolve the crystals in boiling distilled water, filter through a fresh portion of the charcoal, and crystallize again. (*U. S. Ph.*)

3907. To Obtain Gallic Acid from Tannin. Add a strong aqueous solution of tannic acid (tannin) to sulphuric acid, as long as a precipitate falls; collect the powder, wash, and dissolve it by the aid of heat in diluted sulphuric acid; boil for a few minutes, cool, and collect the crystals of gallic acid which will form in considerable quantity.

3908. To Distinguish Gallic Acid from Tannic Acid. Gallic acid does not affect solutions of gelatine, the protosalts of iron, or the salts of the alkaloids; but it produces a black precipitate with the sesquisalts of iron, which disappears when the liquid is heated.

3909. Pyrogallic Acid. This acid is formed in white, shining scales, inodorous, very bitter; soluble in water, alcohol, and ether; fusible at 239° Fahr., and subliming at 410°. When quite pure, it has no action on litmus paper. It is used in photography. A solution of the crude acid mixed with a little alcohol imparts a fine brown color to the hair, but stains the skin also.

3910. To Obtain Pyrogallic Acid. It may be prepared by heating gallic acid (previously dried at 212° Fahr.) in a glass retort, by means of a chloride of zinc bath, to 410°, when the pure acid sublimes, and forms in crystals on the neck of the retort, and in the receiver, which should be kept well cooled.

3911. Tannic Acid, also called *Tannin.* Pure tannic acid is solid, uncrystallizable, white, or slightly yellow; strongly astringent, but without bitterness; very soluble in water, less so in alcohol and ether, and insoluble in fixed or volatile oils. Its solution reddens litmus. With the bases tannic acid forms TANNATES.

Among the incompatibles of tannin are the alkaloids of opium, and it is altogether unavoidable that if solutions of them are brought together, a precipitate will form of tannates; also, if the preparation of opium contain saffron, as in acetum opii and Sydenham's laudanum, this will cause a further precipitation of the extractive of saffron. (*See No.* 3908.)

3912. To Obtain Tannic Acid. Expose nut-gall in fine powder to a damp atmosphere for 24 hours, then mix it with sufficient ether, previously washed with water, to form a soft paste. Set this aside, closely covered, for 6 hours; then envelope it quickly in a close canvas cloth, and obtain the liquid portion by pressing powerfully between tinned plates. Reduce the resulting cake to powder, mix it with sufficient ether shaken with $\frac{1}{16}$ its bulk of water, to form again a soft paste, and express as before. Mix the liquids, and evaporate spontaneously to a syrupy consistence; then spread it on glass or tinned plates, and dry quickly in a drying closet. Put the dry residue in a well-stopped bottle.

3913. Carbonic Acid. An acid compound, formed by the union of carbon with oxygen, sometimes called *choke-damp.* A colorless gas possessing a pungent odor and acidulous taste, rapidly absorbed by water, forming liquid carbonic acid. The agreeable pungency of ale, beer, porter, wine, &c., is in a great measure owing to the presence of carbonic acid, which they lose on exposure to the air, and then become flat and stale. Spring and well water contain carbonic acid, and water that has been boiled has an insipid taste, from its absence. Under a pressure of 36 atmospheres at 32° Fahr. it becomes fluid, and on the pressure being removed, congeals, from the cold produced by its rapid evaporation. It has been estimated that the temperature falls to 180° in this experiment. Carbonic acid gas is destructive to life, and extinguishes combustion. An atmosphere containing more than its natural quantity (about $\frac{1}{1000}$), is unfit for respiration. The air of wells, cellars, brewers' vats, &c., is frequently contaminated with this gas (choke-damp); hence the necessity of the old plan of letting down a burning candle before venturing in. If the candle will not burn, man cannot breathe there. With the bases, this acid forms CARBONATES.

3914. To Obtain Carbonic Acid. Dilute muriatic acid with 4 times its weight of water, then pour it upon fragments of marble, previously placed in a tubulated retort. Carbonic acid gas will be rapidly evolved, and may either be collected in the mercurial pneumatic trough, or applied to immediate use. When wanted perfectly dry, it must be passed over dried chloride of calcium, or through concentrated oil of vitriol. This is the most convenient way of procuring the gas on the small scale, or in the laboratory. Or: Dilute oil of vitriol with 3 or 4 times its weight of water, then pour it on whiting placed in a suitable vessel, and apply agitation. This is the plan adopted on the large scale by the soda water makers. (*See No.* 718.)

3915. Tests for Carbonic Acid. It reddens litmus paper, extinguishes the flame of a burning taper, and forms a white precipitate in aqueous solutions of lime and baryta, which is soluble in acetic acid. By the last test, a very small quantity of this gas may be easily detected in the atmosphere of rooms, &c.

3916. Carbolic Acid, also called *Phenol, Phenic acid,* and *hydrate of Phenyle.* It consists of long, colorless prismatic crystals, which melt at about 90° Fahr. into an oily liquid resembling creosote. The crystals deliquesce in moist air, forming a sort of hydrate, which boils at 370° and has a specific gravity of 1.065. Heated with ammonia, it yields aniline and water; and nitric acid converts it into picric acid. Commercial creosote consists principally of hydrated carbolic acid, but is easily distinguishable from it, as carbolic acid coagulates collodion, creosote does not.

It has come into prominent notice as an efficient disinfectant.

3917. To Obtain Carbolic Acid. This is obtained from that portion of coal-tar which distills over between 300° and 400° Fahr.; this, when mixed with a hot concentrated solution of hydrate of potassa, is resolved, on the addition of water, into a light oil and a heavier alkaline liquid. By separating the latter, and neutralizing it with muriatic acid, impure carbolic acid will float on the surface in the form of a light oil. If this be distilled from dried chloride of calcium to separate the water, and the distillate be exposed to a low temperature, carbolic acid congeals in a colorless deliquescent crystalline mass, which may be separated from the liquid by pressure in bibulous paper. At 95° Fahr. the crystals melt and constitute the liquid carbolic acid. The introduction of a crystal of carbolic acid into the acid to be congealed, greatly facilitates its crystallization.

3918. Tests for the Purity of Carbolic Acid. If it becomes brown under the influence of light and air it is impure.

Put 1 fluid drachm of the liquid acid in a bottle with ½ pint warm water, and shake occasionally for half an hour; the amount of oily residue will indicate the measure of adulteration.

Mix 1 part caustic soda with 10 parts of the acid, and shake them well together. Any undissolved residue is impurity.

3919. To Remove the Odor from Carbolic Acid. It may be interesting to know of a method which will entirely remove this odor, substituting for it a delicate trace of geranium leaves, which may, perhaps, be improved upon by adding a few drops of that oil. The process, as recently published by Professor Church, consists in pouring 1 pound of the best carbolic acid of commerce (the white crystallized) into 2 gallons cold distilled water, taking care not to permit the whole of the acid to enter into solution. With a good sample, if, after shaking repeatedly at intervals, between 2 and 3 ounces of the acid remain at the bottom of the vessel used, this will be a sufficient residue to hold and contain all the impurities; with bad samples, less water must be used, and more acid. The watery solution is to be syphoned off, and filtered, if necessary, through fine filtering paper, till perfectly clear. It is then placed in a tall cylinder, and pure powdered common salt added, with constant agitation, till it no longer dissolves. On standing for a time, the greater part of the carbolic acid will be found floating as a yellow oily layer on the top of the saline liquor, and merely requires to be removed to be ready for use. As it contains 5 per cent. or more of water, it does not generally crystallize, but it may be made to do so by distilling it from a little lime. The portion collected has, at ordinary temperatures, and up to 355° Fahr., scarcely any odor save a faint one resembling that of geranium leaves. The addition of about 4 drops per fluid ounce of the French oil of geranium will still further mask the slight odor of the acid, and has an additional advantage of liquefying the pure crystallized product. The pure acid may be dissolved in 230 parts of water, and used as a gargle, or in 25 parts of water for painting the throat, or in 50 parts for the carbolic spray. By this process it becomes sufficiently deodorized for toilet purposes.

3920. Phosphoric Acid. This acid, in its pure or anhydrous state, can only be obtained by the direct combination of its elements, phosphorus and oxygen, 1 equivalent of phosphorus combining with 5 of oxygen. It consists of a white, flaky, extremely deliquescent powder, which, when fused and cooled, assumes a vitreous appearance. It is capable of assuming three separate conditions in combination with water as a base; the union of 1 equivalent of anhydrous acid with 1 equivalent of water produces *monobasic* or glacial phosphoric acid, called also *metaphosphoric* acid; 1 equivalent of anhydrous acid, with 2 of water, gives *bibasic* or *pyrophosphoric* acid; 1 of anhydrous acid with 3 of water forms *tribasic*, or commercial phosphoric acid. This last is the common form of the acid. These three forms of the acid are not pure phosphoric acid in different degrees of dilution, as they have distinguishing characteristics. Monobasic phosphoric acid coagulates albumen, and gives white gelatinous uncrystallizable precipitates with the soluble salts of baryta, lime, and silver; the *bibasic* does not coagulate albumen, and makes, when neutralized only, a white precipitate with nitrate of silver; the *tribasic* does not affect albumen, and, when neutralized, throws down a yellow precipitate (phosphate of silver) from nitrate of silver. Tribasic phosphoric acid is the usual form under which phosphoric acid combines with the bases to form PHOSPHATES.

3921. To Obtain Phosphoric Acid. This is obtained by heating nitric acid in a tubulated retort connected with a receiver; small fragments of phosphorus are dropped into the acid, singly and at intervals. As soon as the phosphorus is dissolved, the heat is increased, and the undecomposed acid distilled off. The residuum is then evaporated to a syrupy consistence, and forms the *phosphoric acid* of commerce.

3922. To Obtain Hydrated or Glacial Phosphoric Acid. Phosphoric acid (*see last receipt*) is gradually heated to redness in a platinum crucible, and the glacial acid obtained by evaporation. Solid hydrated or glacial phosphoric acid contains 89 per cent. of real acid, and 11 per cent. of water. It is a highly deliquescent, glassy-looking substance, very soluble in water, yielding a solution exhibiting powerful acid properties. Its concentrated solution has nearly the same properties as the solid acid; its dilute solution is not poisonous, and does not precipitate albumen. (*Cooley.*)

3923. Anhydrous Phosphoric Acid. This is evolved by burning phosphorus in a stream of dry air, or under a bell-jar, copiously supplied with dry air. The product is anhydrous phosphoric acid in snow-like flakes. These must be collected immediately, and put into a warm, dry, well-stoppered bottle. A few seconds' exposure to the air causes the anhydrous acid to deliquesce into a syrupy liquid, its attraction for water being intense. Its anhydrous state cannot be restored after deliquescence or solution.

3924. Dilute Phosphoric Acid. Mix 5 troy ounces nitric acid with ½ pint distilled water in a porcelain capsule of the capacity of 2 pints; add 6 drachms phosphorus and invert over it a glass funnel of such dimensions that its rim may rest on the inside of the capsule, near the surface of the liquid. Place the capsule on a sand-bath, and apply a moderate heat until the phosphorus is dissolved, and red vapors cease to rise. If the reaction becomes too violent, add a little distilled water; and if the red vapors cease to be evolved before the phosphorus is all dissolved, gradually add nitric acid (diluted as before) until the solution is effected. Remove the funnel, continue the heat until the excess of nitric acid is driven off, and a syrupy liquid, free from odor and weighing 2 troy ounces, remains. Mix this, when cold, with sufficient distilled water to measure 20 fluid ounces, and filter through paper.

Or: Dissolve 1 troy ounce glacial phosphoric acid in 3 fluid ounces distilled water; add 40 grains nitric acid, boil to a syrupy liquid, free from the odor of nitric acid, add distilled water to make up to 12½ fluid ounces, and filter.

3925. Tests for the Purity of Phosphoric Acid. The U. S. Pharmacopœia directs that an aqueous solution of the acid should yield no precipitate with sulphuretted hydrogen, showing the absence of metals; it should cause a white precipitate with chloride of barium, soluble in excess of acid; and, with an excess of ammonia, should cause only a slight turbidness, proving the almost total absence of earthy salts. If the presence of arsenic is denoted by the tests for that metal, it may be separated by boiling with muriatic acid, so as to convert the arsenic into a volatile chloride, which would escape with vapors of the muriatic acid.

3926. Test for the Presence of Phosphoric Acid. Hydrochloric acid is added to the solution to acid reaction, and afterwards 1 or 2 drops of a concentrated solution of sesquichloride of iron; a solution of acetate of potassa is next added in excess, when a flocculent white precipitate (sesqui-phosphate of iron) will be found if phosphoric acid was present in any form or combination in the original liquor. Arsenious acid, if present, should be removed by sulphuretted hydrogen before applying the test. (*Cooley.*)

3927. Phosphorous Acid. This is prepared by burning phosphorus under a bell-glass with a very limited supply of air. White and pulverulent. It is a powerful deoxidizing agent. With the bases it unites to form PHOSPHITES.

3928. Hypophosphoric Acid. A name erroneously given by M. Dulong to a mixture of phosphoric and phosphorous acids. (*Cooley.*)

3929. Tartaric Acid. Tartaric acid forms inodorous, sour, scarcely transparent prisms, soluble in 2 parts of water at 60°, and its own weight of boiling water. It contains about 9% of combined water, fuses at 220° Fahr., boils at 260°; and, at about 400°, after losing ¼ of its water, is converted into tartralic acid. With the bases it forms salts called TARTRATES. Tartaric acid is chiefly employed in calico printing, and in medicine, as a substitute for citric acid and lemon juice, for the preparation of cooling drinks and saline draughts.

3930. To Obtain Tartaric Acid. On the small scale it is prepared as follows: Dissolve 4 pounds cream of tartar in 2 gallons boiling water; add gradually 12 ounces 7 drachms chalk; and, when the effervescence ceases, add another like portion of chalk, dissolved in 26½ fluid ounces muriatic acid, diluted with 4 pints water; collect the precipitated tartrate of lime, and well wash it with water, then boil it for 15 minutes in 8 pints 1 fluid ounce dilute sulphuric acid; next filter, evaporate to the density 1.38, and set it aside to crystallize. The crystals must be dissolved and crystallized a second and a third time.

On the large scale, the decomposition of the tartar is usually effected in a copper boiler, and that of the tartrate of lime in a leaden cistern. This part of the process is often performed by mere digestion for a few days, without the application of heat. Leaden or stoneware vessels are used as crystallizers. Good cream of tartar requires 26 per cent. of chalk, and 28.5 per cent. of dry chloride of calcium for its perfect decomposition. Dry tartrate of lime requires 75 per cent. of oil of vitriol to liberate the whole of the tartaric acid. A very slight excess of sulphuric acid may be advantageously employed. Some manufacturers bleach the colored solution of the first crystals by treating it with animal charcoal; but for this purpose the latter substance should be first purified by digesting it in muriatic acid, and afterwards by edulcorating it with water, and exposing it to a dull red heat in a covered vessel. The general management of this manufacture resembles that of citric acid. (*Cooley.*)

3931. To Detect Tartaric Acid in Citric Acid. Citric acid is sometimes adulterated with tartaric acid. This is readily detected by adding a solution of carbonate of potassa to a solution of the suspected acid; if tartaric acid be present, a crystalline precipitate of bitartate of potassa (cream of tartar) will be found. A more delicate test is to digest the suspected acid with hydrated sesquioxide of iron in a test tube, and afterwards to raise the heat slowly to the boiling point; allowing the excess of oxide to subside, decant the clear liquid, and evaporate it to a syrupy consistence. If the citric acid was pure, the liquid remains clear and of a fine red color; the presence of only 1 per cent. of tartaric acid renders it cloudy, and deposits tartrate of the sesquioxide. (*U. S. Dis.*)

3932. Citric Acid. This is an agreeable acid, cooling and antiseptic; 20 grains of citric acid are equivalent to 5 fluid drachms lemon juice. When used for making saline draughts, it is preferable to use bicarbonate of potassa as the neutralizing alkali. Their respective saturating equivalents will be found in Nos. 80 and 81. With the bases it forms CITRATES.

3933. To Prepare Citric Acid. Add 4½ ounces chalk by degrees to 4 pints lemon juice, heated, and mix; set by, that the powder may precipitate; afterwards pour off the supernatant liquor. Wash the precipitated citrate of lime frequently with warm water; then pour upon it 27½ fluid ounces diluted sulphuric acid and 2 pints distilled water, and boil for 15 minutes; press the liquor strongly through a linen cloth, and filter it. Evaporate the filtered liquor with a gentle heat, and set it aside that crystals may form. To obtain the crystals pure, dissolve them in water a second and a third time; filter each solution, evaporate, and set it apart to crystallize. The preparation of citric acid has become an important branch of chemical manufacture, from the large consumption of this article in various operations in the arts. In conducting this process some little expertness and care are necessary to ensure success. The chalk employed should be dry, and in fine powder, and be added to the juice until it be perfectly neutralized, and the quantity consumed must be exactly noted. The precipitated citrate of lime should be well washed with water, and the sulphuric acid diluted with 6 or 8 times its weight of water, poured upon it while still warm, and thoroughly mixed with it. The agitation must be occasionally renewed for 8 or 10 hours, when the dilute citric acid must be poured off, and the residuum of sulphate of lime thoroughly washed with warm water, and the washings added to the dilute acid. The latter must then be poured off from the impurities that may have been deposited, and evaporated in a leaden boiler, over the naked fire, until it acquires a specific gravity of 1.13, when the process must be continued at a lower temperature until a pellicle appears upon the surface, This part of the process requires great attention and judgment, as, if not properly conducted, the whole batch may be carbonized and spoiled. At this point the evaporation must be stopped, and the concentrated solution emptied into warm and clean crystallizing vessels, set in a dry apartment, where the thermometer does not fall below temperate. At the end of 4 days the crystals will be ready to remove from the pans, when they must be well drained, redissolved in as little water possible, and, after being allowed to stand for a few hours to deposit impurities, again evaporated and crystallized. When the process has been well managed, the acid of the second crystallization will usually be sufficiently pure; but if this be not the case, a third, or even a fourth crystallization must be had recourse to. The mother liquors from the several pans are collected together, and, by evaporation, yield a second or third crop of crystals obtained by evaporation as before. Citric acid crystallizes with great ease, but in some cases, where all the citrate of lime has not undergone decomposition by the sulphuric acid, a little of that salt is taken up by the free citric acid, and materially obstructs the crystallization. This is best avoided by exactly apportioning the quantity of the sulphuric acid to that of the chalk used, always remembering that it requires a quantity of liquid sulphuric acid, containing exactly 40 parts of dry acid, to decompose 50 parts of carbonate of lime. Commercial sulphuric acid is usually of the specific gravity of 1.845; it will therefore take exactly 49 pounds of this acid for 50 pounds of chalk. In practice it is found that a very slight excess of sulphuric acid is better than leaving any citrate of lime undecomposed. The first crop of crystals is called "brown citric acid," and is much used by the calico printers. Sometimes a little nitric acid is added to the solution of the colored crystals, for the purpose of whitening them, but in this way a minute quantity of oxalic acid is formed. Good lemon juice yields fully 5 per cent. of lemon acid, or 2 gallons yield about 1 pound of crystals. If the imported citrate of lime be used, a given quantity must be heated to redness, and then weighed, when the percentage of lime present will be ascertained; every 28 pounds of which will require 49 pounds of sulphuric acid of 1.845 (or a corresponding quantity containing exactly 40 parts of dry acid) for its complete decomposition.

3934. Tests for the Purity of Citric Acid. When pure, it does not yield a crystalline precipitate when added in excess to a solution of carbonate of potassa; such a precipitate indicates the presence of tartaric acid. It is entirely soluble in water, and what is thrown down by acetate of lead from this solution, is entirely soluble in dilute nitric acid. No salt of potassa, except the tartrate, yields a precipitate with the aqueous solution. It is entirely decomposed by heat; added sparingly to cold lime water, it does not render it turbid, and when a few drops of a solution of citric acid are added to lime water, a clear liquid results, which, when heated, deposits a white powder, soluble in acids without effervescence.

3935. Arsenious Acid. This is the *arsenic* or *white arsenic* of commerce, imported chiefly from Germany, also manufactured in quantity in Cornwall, England. It consists of large, glassy, colorless or yellowish-white, semi-transparent cakes or porcelain-like masses, which soon become opaque on their exterior, and sometimes friable and pulverulent. The transparent arsenic is found to be more than three times as soluble in water at 55° Fahr. than the opaque. In taste it is slightly sweetish, with a slight acidity and astringency, not perceived until some minutes after being swallowed, hence its dangerous character as a poison. Crude arsenic is obtained, as a collateral product, during the smelting of cobalt ores. Pure arsenic is obtained from the crude, by a second sublimation in cast-iron vessels. The arsenic, as imported, has usually been thus purified; and, unless otherwise adulterated, is sufficiently pure for general purposes. It is sometimes kept in fine powder, and in this state is occasionally found adulterated with powdered lime or chalk; it is, therefore, better to purchase it in the lump. The salts of arsenious acid are called ARSENITES.

3936. Self-Detecting Arsenious Acid. By adding a small quantity of any of the following substances to ordinary white arsenic, the mixture changes color when mixed with liquids. This is proposed as a method of preventing mistake in the use of this poisonous article.

The addition of a small quantity of a mixture of dry calomel and quicklime to the arsenic turns *black* when mixed with a liquid.

A mixture of thoroughly dry sulphate of iron and ferrocyanide of potassium turns it *blue*.

Dry sulphate of iron and dry sulphate of soda turns *green*.

3937. Tests for the Presence of Arsenious Acid. A weak solution of ammonio-acetate of copper added to a solution of white arsenic (arsenious acid) throws down a grass green precipitate of arsenite of copper (Scheele's green) This precipitate, after being washed, is soluble in nitric acid, and in ammonia; is turned a brownish-red by a solution of sulphuretted hydrogen, blood-red by ferrocyanide of potassium, and yellow by nitrate of silver.

Arsenious acid in solution throws down a yellow precipitate of arsenite of silver from a solution of ammonio-nitrate of silver.

There are a number of delicate tests employed for detecting the presence of arsenic in organic matter, such as the contents of the stomach or other viscera, all more or less involving the preparation of the matter before applying the tests, and requiring the manipulation of an experienced analytical chemist. A very susceptible test, and recommended by Cooley for its simplicity, is as follows: A solution of the suspected matter is strongly acidulated with muriatic acid in the proportion of 1 part muriatic acid to from 5 to 9 parts of the solution; this is boiled in a porcelain or glass vessel containing bright and clean metallic copper in the form of sheet, gauze, or wire. In about 15 minutes, if the solution be weak, or less, if strong, presence of arsenic will be noted by the characteristic iron-gray film of arsenic deposited on the surface of the copper. The copper, having been carefully washed and dried, may be cut into small pieces and heated in a test tube over a spirit lamp, when the metallic arsenic is volatilized, and will be condensed either in metallic form or in crystals of arsenious acid. This is known as *Rensch's test.*

3938. Arsenic Acid. An acid formed by the combination of metallic arsenic with oxygen. It is sour, reddens litmus, and forms salts with the bases, which are termed ARSENIATES. By careful evaporation it may be obtained under the form of small grains, but usually has the consistence of syrup, being very deliquescent.

3939. To Obtain Arsenic Acid. Pour 6 parts of strong nitric acid on 1 part of white arsenic (arsenious acid) in a glass vessel, and distill until the solution acquires the consistence of a syrup, then transfer it into a platina crucible, and expose it for some time to a faint dull red heat, to expel the nitric acid. The addition of a little muriatic acid facilitates the process.

3940. Tests for the Presence of Arsenic Acid. Sulphuretted hydrogen gives a yellow precipitate; nitrate of silver added to the solution of an arseniate gives a precipitate of a brick red color; nitrate of lead gives a white one, and the salts of copper a bluish colored one. Pure lump sugar dissolved in an aqueous solution of arsenic acid, becomes in a few hours of a reddish color, and afterwards of a magnificent purple. For some test purposes it will be advisable to add sulphurous acid to the suspected liquor, and boil it for a short time, when the arsenic acid will be reduced to arsenious acid, in which state it will be susceptible of more delicate tests. (*See No.* 3937.)

3941. Manganesic Acid—also called *permanganic acid*—may be obtained by mixing 8 parts of binoxide of manganese with 7 parts of chlorate of potassa, both in fine powder, adding 10 parts of hydrate of potassa, dissolved in a small quantity of water, evaporating to dryness, powdering, exposing the powder to a low red heat in a platinum crucible, dissolving the mass in a large quantity of water, decanting, evaporating, and crystallizing. These crystals are *permanganate of potassa,* from which the acid may be obtained by conversion into permanganate of baryta, and by careful decomposition by dilute sulphuric acid. (*Gregory.*) It has a fine red color, bleaches, and is rapidly decomposed by organic matter. It unites with some of the bases to form PERMANGANATES.

3942. Benzoic Acid. This is also called *flowers of benzoin* or *benjamin.* It has the form of white crystalline needles of a silky lustre, possessing an agreeable odor. Benzoic acid fuses at 230° Fahr., is volatile when heated, dissolves sparingly in cold water, with less difficulty in boiling water, and very freely in alcohol. Its salts are called BENZOATES.

3943. To Obtain Benzoic Acid. Put coarsely triturated benzoin into an iron pot with a flat bottom, whose diameter is from 8 to 9 inches; the benzoin forming therein a layer of from 1 to 2 inches in depth. The open end of the pot is then to be covered with a sheet of soft and loose blotting-paper, which must be attached to the rim with paste. A cone, formed with strong and thick paper, (cartridge paper), is then to be capped over the top of the pot, including the blotting paper; and this is also to be attached with paste and string. The apparatus, thus prepared, should then be placed on the sand-bath, and exposed from 4 to 6 hours to a gentle heat. After this lapse of time, it may be removed from the sand-bath, inverted, and the string detached, when beautiful white needles, of a silky lustre, possessing the agreeable odor of benzoic acid, will be found in the paper cone.

3944. To Obtain Anhydrous Benzoic Acid. Add oxychloride of phosphorus to an excess of benzoate of soda; agitate together, and wash the mixture with boiling water. The anhydrous benzoic acid sinks like a heavy oil, and crystallizes on cooling.

3945. Chromic Acid. This consists of acicular crystals of a crimson-red color and an acid metallic taste, deliquescent, and very soluble in water, forming an orange-yellow solution. With the bases this acid forms CHROMATES. Chromate of lead forms the pigment known as *chrome-yellow.*

3946. To Obtain Chromic Acid. Take 10 measures of a saturated cold solution of bichromate of potassa, mix with it 15 measures sulphuric acid, and allow the mixture to cool. The chromic acid is deposited in crystals, which, after decanting the mother liquid, are placed on a tile to drain, covered with a bell glass.

3947. Hydrocyanic Acid. This is also called *prussic acid,* and consists of a thin, colorless, and volatile liquid, having a strong odor of peach kernels. It boils at 79° Fahr. and solidifies at 45°; its specific gravity is

.7058. It constitutes one of the most deadly poisons known. Its salts are HYDROCYANATES and METALLIC CYANIDES. Prussic acid, even when dilute, is very liable to spontaneous decomposition, and this speedily occurs when it is exposed to the light. To promote its preservation, it is usual to surround the bottles containing it with thick purple paper, and to keep them inverted in an obscure situation. The addition of a very small quantity of muriatic acid renders it much less liable to change, and is generally made by manufacturers for that purpose.

3948. To Obtain Anhydrous Prussic Acid. Pure crystallized ferrocyanide of potassium, 15 parts; water and sulphuric acid, of each 9 parts; distill in a glass retort into a well-cooled receiver, containing chloride of calcium in coarse fragments, 5 parts; stop the process as soon as the chloride in the receiver is perfectly covered by the distilled fluid, and decant the acid into a bottle furnished with a good stopper. Keep it in the dark, with the bottle inverted.

3949. Dilute Prussic Acid. Mix 41 grains muriatic acid with 1 fluid ounce distilled water, add 50½ grains cyanide of silver, and shake together in a well stopped phial. When the precipitate has subsided, pour off the clear dilute acid and keep for use. (*See No.* 3947.) (*U. S. Ph.*)

3950. Tests for the Presence of Prussic Acid. It is distinguished by a strong odor of bitter almonds.

Neutralized by potash, and tested with a solution of sulphate or tincture of iron, it gives a blue precipitate, or one turning blue on the addition of dilute sulphuric or muriatic acid. This test may be applied by spreading a single drop of solution of potassa over the bottom of a white saucer or porcelain capsule, and inverting it over another vessel of the same size containing the matter under examination. After 2 to 5 minutes remove the upper capsule; add to the potassa upon it, a single drop of a solution of sulphate or tincture of iron, and expose it to the air for a few seconds. Next add 1 or 2 drops of dilute sulphuric acid, when a blue color will be developed if hydrocyanic acid is present in the matter tested.

Nitrate of silver gives a white clotty precipitate, soluble in boiling nitric acid; and which, when dried and heated in a test tube, evolves fumes of cyanogen, which burn with a violet or bluish colored flame. A watch glass, moistened with this test and inverted over matter containing hydrocyanic acid, becomes opaque and white from the formation of cyanide of silver.

Liebig's test is considered the most delicate. Moisten a watch-glass or porcelain capsule with 1 or 2 drops of yellow hydrosulphuret of ammonia; invert it over the matter as before, and after a few minutes dry it with a gentle heat. A glass rod dipped in a solution of a persalt or sesquisalt of iron, drawn over the glass, will form a blood-red streak if the smallest quantity of hydrocyanic acid is present. (*Cooley.*)

3951. Test for the Strength of Prussic Acid. For estimating the strength of the commercial acid the following plan, proposed by Dr. Ure, will be found very exact and convenient. To 100 grains, or any other convenient quantity of the acid contained in a small phial, add in succession, small quantities of the peroxide of mercury in fine powder, till it ceases to be dissolved on agitation. The weight of the red precipitate taken up being divided by 4, gives a quotient representing the quantity of real prussic acid present. By weighing out beforehand, on a piece of paper or a watch-glass, 40 or 50 grains of the peroxide, the residual weight of it shows at once the quantity expended. The operation may be always completed in five minutes, for the red precipitate dissolves as rapidly in the dilute prussic acid, with the aid of slight agitation, as sugar dissolves in water. Should the presence of muriatic acid be suspected, then the difference in the volatility of prussiate and muriate of ammonia may be had recourse to with advantage; the former exhaling at a very gentle heat, the latter requiring a subliming temperature of about 300° Fahr. After adding ammonia in slight excess to the prussic acid, if we evaporate to dryness at a heat of 212°, we may infer from the residuary sal-ammoniac the quantity of muriatic acid present. Every grain of sal-ammoniac corresponds to .6822 grains of muriatic acid.

3952. Cyanic Acid. A compound of cyanogen and oxygen only known in its hydrated state in combination with 1 equivalent of water. It combines with bases to form CYANATES. When in contact with water for a few hours it suffers decomposition, and is converted into bicarbonate of ammonia. It cannot be preserved for any length of time, as it soon passes spontaneously into a white, opaque, solid mass, to which the name of *cyamelide* has been given, which may be reconverted into cyanic acid by distillation. It reddens litmus strongly.

3953. To Obtain Cyanic Acid. Distill dry cyanuric acid, or cyamelide, in a retort, and collect the product in a well-cooled receiver. It is also formed when cyanogen is transmitted over carbonate of potassa heated to redness; a cyanate of potassa results.

Or: Pass a current of sulphuretted hydrogen gas through water in which cyanate of silver is diffused. The sulphuretted hydrogen must not be passed so long as to decompose all the cyanate of silver; for then the cyanic acid is converted into other products by the excess of the sulphuretted hydrogen.

3954. Hydroferridcyanic Acid. This is sometimes written *hydroferricyanic acid,* and is a compound of ferridcyanogen and hydrogen. With the oxides of metals this acid forms FERRIDCYANIDES; the ferridcyanide of potassium is the *red prussiate of potash* used in the arts.

3955. To Obtain Hydroferridcyanic Acid. Prepared by decomposing recently precipitated ferridcyanide of lead by sulphuretted by hydrogen, or by sulphuric acid carefully added. A yellow solution is thus obtained, which yields a deep brown powder when evaporated by heat, or yellow crystals by spontaneous evaporation.

3956. Hydroferrocyanic Acid. A peculiar compound of cyanogen, hydrogen, and iron, discovered by M. Porret, and called by him *ferrochyazic acid.* It consists of white or yellowish white crystals, soluble in water and alcohol. With metallic oxides it combines to form FERROCYANIDES or PRUSSIATES. The ferrocyanide of potassium is the *yellow prussiate of potash* of commerce.

3957. To Obtain Hydroferrocyanic Acid. It may be obtained from a concentrated boiling solution of ferrocyanide of potassium, cooled out of contact with the air, and muriatic acid added in excess. The mixture is then agitated with a little ether, which separates the acid; the latter is collected by filtration, and dried.

3958. Lactic Acid. This is a limpid, syrupy liquid, colorless or of a pale wine color, with a slight odor and very sour taste. It is found in sour milk, and some other animal fluids, and in several vegetable juices, especially in that of beet-root. It unites with bases to form LACTATES.

3959. To Obtain Lactic Acid. Ferment whey by keeping it at a temperature of 70° to 80° Fahr.; evaporate the liquor to ⅙ its bulk; decant and filter, and then saturate it with milk of lime. This converts the lactic acid into lactate of lime, which remains in solution. The liquor is filtered again and precipitated by oxalic acid, which throws down oxalate of lime and sets free the lactic acid. The liquid is again filtered, and the filtrate consists of a solution of lactic acid, containing some sugar of milk (*lactin*) and certain salts. Next concentrate the solution to a syrupy consistence, and treat it with alcohol, which dissolves the acid and precipitates all the other matter. The solution is finally filtered and the lactic acid obtained pure by distilling off the alcohol. (*U. S. Dis.*)

3960. Fluoric Acid. This is more strictly *hydrofluoric acid,* as it is a compound of hydrogen and fluorine. Its combinations with bases are called FLUORIDES or HYDROFLUORATES. The well known mineral, *fluorspar,* is a fluoride of calcium. Fluoric acid readily dissolves glass and silica, hence it is kept in bottles of lead, silver, platinum, or pure gutta-percha. It is highly corrosive and its vapor is poisonous. It is a colorless fluid which evaporates at 59° Fahr. in dense white fumes when exposed to the air, and has a powerful affinity for water.

3961. To Obtain Fluoric Acid. The anhydrous acid is made by distilling powdered fluor-spar with twice its weight of oil of vitriol in a leaden, or better, a silver alembic, the pipe of which fits into a bottle of the same material, surrounded with ice. But as it is usually required in a diluted state, water equal in weight to the spar may be put into the receiver. Great care must be taken, as the acid, both in its gaseous and liquid form, is very destructive.

3962. Chloric Acid. This is a yellowish liquid, smelling like nitric acid; it sets fire to paper or other dry organic matter. It is a compound of chlorine and oxygen, and in combination with bases forms CHLORATES.

3963. To Obtain Chloric Acid. Dissolve chlorate of baryta in 16 times its weight of water; then add dilute sulphuric acid until all the baryta be precipitated as sulphate. The clear liquid may then be concentrated by evaporation to a thin, oily consistence.

3964. Perchloric Acid. A colorless liquid of about 1.65 specific gravity, which fumes slightly in the air, attracts moisture, and distills unchanged at about 392° Fahr. (*Cooley.*) With bases it forms PERCHLORATES.

3965. To Obtain Perchloric Acid. To finely powdered perchlorate of potassa contained in a retort, add about ⅓ its weight of strong sulphuric acid, previously diluted with an equal weight of water. At about 284° Fahr., vapors of perchloric acid pass over and condense in the receiver. (*Cooley.*) No organic matter should be used as a lute for the joints of the apparatus; if any be needed, it should be of asbestos. By distilling the concentrated liquid acid with oil of vitriol at a gentle heat, crystals of perchloric acid will be deposited on the neck of the retort and in the receiver. These crystals fuse at 113° Fahr., and are very deliquescent. (*Booth.*)

3966. Butyric Acid. A thin, colorless, oily liquid, soluble in water and alcohol; specific gravity .963; boils at 327° Fahr. It may be procured from the butyrate of magnesia by adding a little sulphuric acid in quantity not quite sufficient to decompose the whole of the butyrate used; filter and distill the clear liquor, when the product will be butyric acid, from which the water may be removed by chloride of calcium. It forms *butyrates* with some of the bases. (*See No.* 1625.)

3967. Malic Acid. Malic acid is very soluble in water, slightly deliquescent, has a pleasant acidulous taste, and, when neutralized with the bases, forms salts called *malates.* When kept fused for some time at a low heat, it is converted into *paramalic* or *fumaric acid;* and when quickly distilled, it yields *maleic acid,* while fumaric acid is left in the retort. Malic acid forms with bases, MALATES; maleic acid, MALEATES. Take the juice of the fruit of the mountain ash, immediately after it has turned red, but still unripe; heat it to the boiling point, skim, filter, nearly neutralize with ammonia, and precipitate with a solution of 1 part of acetate of lead to every 72 parts of juice; filter, and again precipitate with nitrate of lead; allow the whole to stand until it forms a mass of crystals, then well wash, dry, powder, suspend in water, and decompose by a current of sulphuretted hydrogen; again filter, neutralize with ammonia, decolor with animal charcoal, a second time precipitate with nitrate of lead, and decompose the resulting nitrate of lead by sulphuretted hydrogen; lastly, filter, evaporate and crystallize. (*Winckler.*) Mr. Everett proposes the juice of the leaf-stalks of garden rhubarb as a source of malic acid. One imperial gallon of this juice contains 11,139¼ grs. of dry malic acid. The stalks should be peeled before pressing out the juice, as the cuticle contains much color. Everett's process is as follows: Neutralize with hydrate of lime, boil, filter, precipitate with nitrate of lead, allow it to stand for a few hours, boil, cool, filter, decompose the precipitate with sulphuric acid, avoiding excess, throw down the excess of lead from the supernatant portion with sulphuretted hydrogen, evaporate, and crystallize. Malic acid is also obtained from the juice of apples and several other sorts of fruit.

3968. Iodic Acid. A compound of iodine and oxygen, forming IODATES with the bases. It is deliquescent and very soluble in water, and detonates with inflammable bodies like the nitrates and chlorates.

3969. To Obtain Iodic Acid. Dissolve iodate of soda in sulphuric acid in considerable excess, boil for 15 minutes, and set the solution aside to crystallize.

Or: Iodine, 1 part; strongest (monohydrated) nitric acid, 4 parts; mix, and apply a gentle heat until the color of the iodine disappears, then evaporate to dryness and leave the residuum in the open air at a temperature of about 59° Fahr. When, by attracting moisture, it has acquired the consistence of a syrup, put it into a place where the temperature is higher and the air drier, when, in a few days, very fine white crystals of rhomboidal shape will form.

Mr. A. Connell's method is as follows: Put 50 grains of iodine into a large, tall flask: add 1 ounce of fuming nitric acid, boil, and as the iodine sublimes and condenses on the sides of the flask, continually wash it back again with the acid. Continue this until none of the iodine remains unchanged. Then pour the whole into a shallow evaporating dish, and evaporate to dryness. Redissolve, and again evaporate till all the nitrous acid is got rid of.

3970. Hydriodic Acid. This is a compound of iodine and hydrogen. In gaseous form it is colorless, fumes in the air, and is very soluble in water. In liquid form, when strong, it is very liable to change, and should be kept in well stoppered bottles. In combination with bases it forms HYDRIODATES. The hydriodates may be easily formed by saturating the acid with the oxides or hydrates of the bases, or more economically, by acting on the bases in water, with iodine. When the hydriodates are deprived of their water, they are true IODIDES; that is, simple combinations with iodine. (*See No.* 3853.)

3971. To Obtain Hydriodic Acid. Pour a little water over some periodide of phosphorus, previously put into a small glass retort, and apply a gentle heat, when gaseous hydriodic acid will be evolved, and phosphoric acid remain behind. The gas may be either collected over mercury or passed into water, when liquid hydriodic acid will be formed.

Or: Place iodide of barium in a retort, and decompose it with sulphuric acid, when pure hydriodic acid will be evolved.

3972. Dilute Hydriodic Acid. Take 1 troy ounce iodine in fine powder. Mix 30 grains of the iodine with 5 fluid ounces distilled water in a tall glass-stoppered ½ pint bottle, and pass into the mixture hydrosulphuric acid gas until the color of the iodine entirely disappears, and a turbid liquid remains. Next, gradually add the remainder of the iodine, stirring at the same time. Again pass the gas through the liquid until it becomes colorless, and decant it into a small matrass which it must nearly fill; boil it until it ceases to give off the odor of hydrosulphuric acid, and filter through paper, passing sufficient distilled water through the filter to bring the filtered liquid to 6 fluid ounces. Keep it in a well-stoppered bottle. (*U. S. Ph.*)

Alkalies.

Substances which possess the property of neutralizing acids and combining with them in fixed proportions, forming salts, and for the most part of turning the vegetable blues to greens, and yellow turmeric paper brown. The principal alkalies are soda, potassa, and ammonia. The first has been called the mineral, the second the vegetable, and the third the volatile alkali; but this distinction is now obsolete. Soda and potassa have also been called the fixed alkalies, from their permanence in the fire. The alkalies are strictly metallic oxides. The salts of the alkalies, both alone and carbonated, are generally freely soluble in water. The methods for ascertaining the strength of alkalies and their solutions will be found under Alkalimetry, No. 83.

3974. Potassa. Pure potash (not the potash of commerce, which is an impure carbonate of potassa), is the oxide of potassium. It occurs in two forms, *anhydrous* and *hydrated* potassa. As a general distinction, the term *potash* applies to the crude commercial, and *potassa* to the more purified or chemical preparations.

3975. Anhydrous Potassa. This is a volatile, fusible, white substance, intensely corrosive, and passing into the hydrate of potassa when moistened with water. It is obtained by the combustion of potassium in hot dry air.

3976. Hydrate of Potassa. Hydrated or *caustic potassa,* when perfectly pure, is white, solid, very soluble in water and in alcohol, very deliquescent, and corrosive. To obtain it, evaporate solution of potassa rapidly in an iron vessel over the fire until ebullition ceases and the potassa melts. Pour this into suitable moulds, and, when cold, put it into stoppered bottles.

3977. Tests for Potassa. Potassa may be distinguished from the other fixed alkalies (soda and lithia), by affording, when in solution, a white crystalline precipitate (cream of tartar) with an excess of tartaric acid; and a yellow one with bichloride of platinum. The flame of burning alcohol containing potassa has a reddish tint; soda colors it yellow.

3978. Soda. This substance bears the same relation to its metallic base, *sodium,* that potassa does to potassium, but its basic and alkaline action are rather less powerful than those of potassa.

3979. To Obtain Soda. Pure soda and hydrate of soda (caustic soda) are obtained from carbonate of soda in a similar manner to the same preparations of potassa. Caustic soda is occasionally called *sodic hydrate.*

3980. Tests for Soda. The flame of burning alcohol containing soda is of a yellow color. Hydrate of soda, after it has deliquesced in the air, speedily resolidifies by the absorption of carbonic acid, forming carbonate of soda, a salt marked by being easily crystallizable, and rapidly efflorescing in dry air. In solution, soda is not precipitated by tartaric acid. With sulphuric acid it yields a salt, which by its taste (intensely bitter) and form (six-sided prisms, transparent, and extremely efflorescent) is easily recognized as sulphate of soda (Glauber's salt).

3981. Ammonia. Pure ammonia is an incondensable colorless gas, possessing great pungency and acridness, and powerful alkaline properties. Water readily absorbs about 500 times its volume of this substance, and in this state forms strong liquid ammonia, which, when much more dilute, is popularly known as spirits of hartshorn, or water of ammonia. As usually met with in the form of a semi-crystalline whitish mass, commonly called smelling salts, it is combined with carbonic acid and water, forming a sesquicarbonate of this base. According to the theory of Berzelius, ammonia should be the oxide of ammonium, a supposed but undiscovered metal. Its presence can always be detected by its pungent odor.

3982. To Obtain Ammonia. Mix unslacked lime with an equal weight of sal-ammoniac, both dry and in fine powder; introduce the mixture into a glass retort, and join the beak by a collar of India-rubber to a glass tube about 18 inches long, which must lie horizontally, and have its beak bent up ready to be placed under a glass jar, on the shelf of a mercurial pneumatic trough. Heat being applied by means of a spirit-lamp, and the air contained in the apparatus having been expelled, the gas may be collected for use. Ammonia cannot be dried by means of chloride of calcium.

3983. Lithia. This is the oxide of lithium; is caustic, alkaline, and sparingly soluble in water. One of its most remarkable properties is its power of corroding platinum. In the form of the hydrate it is white and translucent, does not deliquesce, but absorbs carbonic acid and becomes opaque. It is to be obtained from various minerals, and is also found in some mineral waters; among which is that of the Gettysburg spring. Pure lithia may be obtained by decomposing sulphate of lithia by acetate of baryta, and by expelling the acetic acid from the filtered solution by heat.

3984. Tests for Lithia. It colors the flame of alcohol containing it a carmine red. It is distinguished from potassa and soda by its phosphate and carbonate being only sparingly soluble in water; from baryta, strontia, and lime, by forming crystallizable and soluble salts with sulphuric or oxalic acid; and from magnesia, by the solution of its carbonate exhibiting an alkaline reaction.

3985. Baryta. This alkaline earth is the oxide of barium, and is found abundantly in the form of native sulphate and carbonate of baryta. With the acids it forms salts which are all more or less white; except the sulphate, they are soluble in water, or in dilute muriatic acid, and are extremely poisonous.

3986. To Obtain Pure Baryta. Ignite pure crystallized nitrate of baryta in a capacious porcelain crucible, until red vapors cease to be evolved. This forms a grayish white mass or powder, which, on the addition of water, slacks like lime, but with the evolution of more heat.

3987. To Obtain Hydrated Baryta. It may be precipitated from a solution of either nitrate or chloride of barium, by adding to it a solution of pure potassa or soda, collecting and drying the precipitate. It is obtained in crystals, by boiling a strong solution of sulphuret of barium with successive portions of black oxide (protoxide) of copper, until it ceases to give a black precipitate with a salt of lead. The liquid, after filtration, yields crystals of hydrate of baryta on cooling.

3988. Test for Baryta. Its solutions give an immediate clear white precipitate with dilute sulphuric acid, which is insoluble in both acids and alkalies.

3989. Strontia. An alkaline earth, the oxide of a metal called strontium. It greatly resembles baryta. Hydrate of strontia is freely soluble in boiling water, and the saturated solution deposits crystals on cooling. The solution exhibits an alkaline reaction, and, like baryta, is precipitated white by sulphuric acid and the alkaline sulphates and carbonates. It is distinguished from baryta by its inferior solubility and by its soluble salts giving a red tinge to flame, while the salts of baryta impart a yellow tinge. The salts of strontia may all be prepared by dissolving the native carbonate in the respective acids. The nitrate is the only one met with in commerce, and is employed to form colored fireworks.

3990. Magnesia. An alkaline earth, the oxide of the metal magnesium, in the form of a very light, white, odorless and tasteless powder, almost insoluble in cold and boiling water. It slowly absorbs carbonic acid from the atmosphere. With the acids it forms salts, most of which may be made by the direct solution of the earth, or its hydrate or carbonate. It dissolves in hydrochloric acid without effervescence. Neither bicarbonate of potassa nor chloride of barium throws down anything from the solution. It turns turmeric paper brown when moistened.

3991. To Obtain Magnesia. Expose carbonate of magnesia in a crucible to a full red heat for 2 hours, or till the powder suspended in water does not effervesce on the addition of muriatic acid. On the large scale, covered crucibles, made of porous earthenware, are employed as the containing vessels, and the heat is applied by placing them in a sort of furnace or oven heated with coke.

3992. Test for Magnesia. Magnesia is precipitated as a bulky white hydrate, by pure alkalies; and as a bulky white carbonate, by the carbonates of potassa and soda. Both the above precipitates dissolve in nitric and muriatic acid, forming salts which are very deliquescent, and soluble in alcohol.

Solutions of magnesian salts are not precipitated by the alkaline sulphates or sulphuric acid, nor, when very dilute, by oxalate of ammonia. By these tests it may be distinguished and separated from lime. These tests distinguish it from the other earths, and its insolubility in alkaline solutions marks its difference from alumina.

3993. Lime. A highly acrid, alkaline and caustic earth, less insoluble in cold than in hot water. It is the oxide of calcium. When heated to a high degree, it becomes intensely luminous, and is well known in use as the calcium light.

3994. To Obtain Lime. Lime, or *quicklime,* is obtained by exposing limestone, or chalk, which are carbonates of lime, to a red heat. *Shell-lime* is got in the same manner from the shells of the oyster and other shellfish. When sprinkled with water, heat is generated, and the lime, combining with the water, crumbles down into a powder, which is *hydrate of lime,* or slacked lime.

3995. Tests for Lime. The alkaline carbonates, phosphates, oxalates, and sulphates, occasion white precipitates in solutions of lime. The precipitates occasioned by the first three tests are soluble in dilute nitric or muriatic acid; that by the last is insoluble in those menstrua, but soluble in solution of salt, and not reprecipitated by dilute sulphuric acid.

Oxalate of ammonia or potassa is the most delicate test of lime. If the substance under examination be a solid, dissolve it in muriatic acid, filter, evaporate to dryness, redissolve in water, and test as above. All the soluble salts of lime tinge the flame of alcohol of an orange color, but this may be confounded with the color produced by the salts of strontia.

Alkaloids.

Substances of a vegetable origin, analogous to the alkaline bases, in which the medicinal activity of the plants in which they are found appear to reside. (*Cooley.*) Among the natural organic bases, or alkaloids, the following are the principal, as enumerated by Professor Fownes.

3997. Morphine or Morphia. This is the chief active principle of opium. The morphia of commerce is a white crystalline powder; but when crystallized in alcohol, forms brilliant, prismatic, transparent, and colorless crystals, which turn nitric acid red. In powder, unlike strychnine, it is fusible without decomposition, and strongly decomposes iodic acid. It is insoluble in ether, scarcely soluble in water, and freely soluble in alcohol. Potassa and ammonia precipitate morphia from the solutions of its salts.

3998. To Find the Percentage of Morphia in Opium. An excellent process for ascertaining the quality of opium is to boil an infusion of 100 grains opium with 25 grains quicklime, made into a milk with water; to filter while hot, saturate with a dilute hydrochloric acid, and to precipitate the morphia by ammonia. After expelling any excess of ammonia by heat, the precipitate is collected, dried, and weighed; the weight in grains will nearly represent the percentage of morphia in the opium.

3999. Narcotine. An alkaloid found in the insoluble portion of opium, and forms small, colorless, brilliant crystals, which give to nitric acid an orange tint.

4000. Codeine, or Codeia. Obtained from hydrochlorate of morphia, in colorless, transparent, eight-sided crystals, which do not color nitric acid red.

4001. Thebaine, or Paramorphine. This is also obtained from opium in colorless needles like those of narcotine. It does not color nitric acid red, and is much less soluble in water than codeine.

4002. Cinchonine, or Cinchonia. This is the active principle of Peruvian bark, contained in the largest quantity in the pale bark. It crystallizes in small, brilliant, transparent, four-sided prisms, insoluble in ether. *Cinchonicine* and *cinchonidine* are other varieties of this alkaloid.

4003. Quinine, or Quinia. This is also obtained from Peruvian bark, being found in largest quantity in the yellow variety of the bark. It crystallizes in small white needles. It may be distinguished from cinchonine by the form of its crystals, and its solubility in ether.

4004. Quinoidine, or *Amorphous Quinine,* is a yellow or brown resinous mass, identical in composition with quinine. *Quinicine* and *quinidine* are also varieties of quinine. (*See Nos.* 4025, *&c.*)

4005. Strychnine, or Strychnia. This is an alkaloid contained in nux vomica, and some other vegetable substances. Crystallizes in small, brilliant, eight-sided crystals, insoluble in absolute alcohol, and slightly soluble in water. It suffers decomposition on fusing, and does not decompose iodic acid; it may be thus distinguished from morphine.

4006. Brucine, or Brucia. Is obtained from the same sources as strychnine, and resembles it in many respects, but is readily soluble in all strengths of alcohol, and insoluble in water. Brucine turns nitric acid red, which becomes violet on the addition of protochloride of tin.

4007. Veratrine, or Veratria. The alkaloid principle of cevadilla seeds, and of white hellebore. When pure, it is a white powder; but as usually met with, the powder is yellowish or greenish-white, insoluble in water.

4008. Colchicine. Extracted from the seeds of the common meadow saffron; has similar properties to veratrine, but is crystalline, and soluble in water.

4009. Harmaline. A substance forming yellowish prismatic crystals, obtained from the Peganum Harmala, a plant abounding in southern Russia. By oxidation it yields *Harmine,* a fine red dye-stuff, also possessing basic properties.

4010. Theine, or Caffeine. This is an alkaloid principle extracted from tea, coffee, Paraguay tea, &c. It forms in tufts of white silky needles.

4011. Theobromine. A white crystalline powder obtained from the cacao-nuts from which chocolate is prepared. Its properties are somewhat similar to theine.

4012. Xanthine. A white powder, which may be obtained from guanine, which it resembles in its properties. It dissolves easily in ammonia or potash.

4013. Creatine. This alkaloid, called by some *kreatine,* is a crystallizable substance obtained from the juice of the muscular fibre of animals. It forms brilliant, colorless prismatic crystals. Creatine is a neutral body combining with neither acids nor alkalies. By the action of strong acids it is converted into *creatinine,* a powerful organic base, with a strong alkaline reaction, and forming crystallizable salts with acids. Creatine, treated by boiling with a solution of baryta, produces *Sarcosine.*

4014. Sarcine. This base is a constituent of the flesh of animals. It forms in delicate white microscopic needles, soluble with difficulty in cold water, easily in boiling water. It is obtained from the same source as creatine. (*See No.* 4013.)

4015. Guanine. A base obtained from guano. It is a colorless, crystalline powder, insoluble in water, alcohol, ether or ammonia. By treating guanine with muriatic acid and chlorate of potassium, *guanidine* is obtained in colorless crystals, readily soluble in water and alcohol.

Guanine, Sarcine, and Xanthine greatly resemble one another.

4016. Berberine. An alkaloid crystallizing in fine yellow needles slightly soluble in water, extracted from Barberry root.

4017. Piperine. An alcoholic extract of pepper forming colorless or yellowish crystals. Insoluble in water.

4018. Conine, or Conia. An alkaloid extract of hemlock, in the form of a volatile, oily liquid. It evolves an odor of hemlock on being moistened with a solution of potassa.

4019. Nicotine, or Nicotia. This is also a volatile, oily, acrid liquid, soluble in water, ether, alcohol, and oils. Nicotine, moistened with a solution of potassa, evolves a strong odor of tobacco.

4020. Sparteine. An alkaloid obtained from broom, also a volatile, oily liquid. Conine, nicotine, and sparteine are similar in character, being very poisonous, possessing strong alkaline reaction, and forming crystallizable salts with the acids.

4021. Salicine. A white, crystalline substance, found in the bark and leaves of several kinds of poplar and willow; but most abundantly in the white willow and the aspen. It is obtained by the careful evaporation of an infusion in cold water.

4022. To Obtain Alkaloids. Some of these substances require special processes for extracting them from the substances in which they are found, but the following methods will apply for general purposes:

When the base is insoluble in water, non-volatile, and existing in the plant in an insoluble form. Boil or macerate the bruised plant in water acidulated with muriatic acid, filter, neutralize the acid with an alkali, (ammonia, lime, or magnesia), and collect the precipitate, which must be purified by resolution in dilute acid, digestion with animal charcoal, and subsequent crystallization or precipitation by an alkali; or the first precipitate may be purified by dissolving it repeatedly in alcohol.

When the base is insoluble in water, and non-volatile, but existing in the plant in a soluble state. Boil or macerate in hot water as before; filter and precipitate by adding an alkali; purify as last.

When the base is soluble in water, and non-volatile. Make an infusion with a dilute acid (muriatic); concentrate by a gentle heat; treat the liquor with potassa and ether (conjointly); decant and evaporate.

When the base is both soluble in water and volatile. The vegetable or its extract may be mixed with potassa and distilled; the product, neutralized with oxalic or sulphuric acid, carefully evaporated to dryness, and digested in alcohol, and this solution agitated with potassa and ether; the ethereal solution thus formed, if carefully evaporated, leaves the base nearly pure. It may be further purified by cautious distillation.

4023. Tests for Distinguishing Alkaloids. Perchloride of gold is a decisive test of certain vegetable alkalies. The following are the colors of the precipitates which it produces with the salts of the annexed alkalies dissolved in water; *quinine,* buff-colored; *cinchonine,* sulphur-yellow; *morphine,* yellow, then bluish, and lastly, violet; in this last state the gold is reduced, and the precipitate is insoluble in water, alcohol, the caustic alkalies, and sulphuric, nitric, or hydrochloric acids; *brucine,* milk, coffee, and then chocolate-brown; *strychnine,* canary-yellow; *veratrine,* slightly greenish-yellow. All these precipitates, with the exception mentioned, are very soluble in alcohol, insoluble in ether, and slightly soluble in water. Among the reactions of chloride of gold, there are two which appear to be especially important: they are those which occur with morphine and brucine; these are sufficiently marked to prevent these alkalies from being mistaken for each other, and also yield pretty good characteristics for distinguishing brucine from strychnine.

4024. Alkaloids Detected by Picric Acid. Hager has found that this acid precipitates various alkaloids from their solutions, such as brucine, strychnine, veratrine, quinine, cinchonine, and some alkaloids of opium. Morphine and atropine, however, are precipitated only from neutral and concentrated solutions, and the precipitate dissolves pretty easily in water. Glucosides, casein, and pseudo-morphine resist the action of the picric acid.

4025. Quinometry. The method of estimating the quantity of quinine in cinchona bark and the salts obtained from it. The following tests give very accurate results in examining the bark; and the salts are tested in the same way, but the result is not quite so accurate, as it includes any *quinidine* (*see No.* 4028) that may be present in the quinine; and makes, therefore, the apparent richness of the sample greater than it really is. (*Cooley.*)

4026. Test for the Strength of Quinine. Make a decoction of 100 grains of bark in 2 fluid ounces distilled water; filter, and precipitate with a sufficient quantity of a concentrated solution of carbonate of soda. Heat the fluid until the precipitate is dissolved; and when cold, dry and weigh it. It should weigh 2 grains or more, and dissolve entirely in a solution of oxalic acid. To render the result strictly accurate, the bark should be exhausted with ether, and the mixed solutions evaporated. Salts of quinine may be tested in the same manner. (*Cooley.*)

4027. Test for the Percentage of Quinine in Bark, &c. Exhaust 100 grains of bark with acidulated water; filter the solution, and render it alkaline with liquor of potassa; next agitate it with about ⅛ its volume of chloroform, and allow it to repose a short time; the chloroform, holding the alkaloid in solution, sinks to the bottom of the vessel in a distinct stratum, from which the supernatant liquid must be separated by decantation; the chloroformic solution, either at once or after being washed with a little cold water, is allowed to evaporate, and the weight of the residuum in grains gives the percentage of richness of the sample. Ether may be used instead of chloroform, but the ethereal solution will form the upper stratum instead of the lower. This test is also applicable to the salts of quinine, but with restrictions referred to in No. 4025. (*Rebourdain.*)

4028. Quinidine. An alkaloid found in quinia which has been prepared by precipitation. It is distinguished from quinine by not striking a green color when treated with chlorine followed by ammonia, as quinine does. In medicinal character its powers are comparatively feeble. It is present in nearly all the ordinary sulphate (disulphate) of quinine as sold, either through careless preparation or wilful adulteration, and is not detected by, and consequently included in, the results of the usual tests for quinine. (*See Nos.* 4025, *&c.*) *Cinchonine* is another feebler alkaloid also found in quinia.

4029. Ure's Test for the Presence of Quinidine or Cinchonine in Quinine. This test is applicable to quinine salts generally, but more especially refers to the sulphate (disulphate) of quinine. Place 10 grains of the salt into a strong test tube, furnished with a tightly-fitting cork; add 10 drops of a mixture of 1 part sulphuric acid and 5 parts water, and 15 drops water, accelerating solution by a gentle heat. When dissolved and entirely cooled, add 60 drops officinal sulphuric ether with 20 drops spirits of ammonia, close the test tube with the thumb, and shake it well; cork the tube closely and shake gently from time to time, so that the bubbles of air may readily enter the layer of ether. If the salt be free from, or contain no greater proportion than 10 per cent. of quinidine, it will be entirely dissolved; while on the surface of contact between the two strata of fluid, the mechanical impurities only will be separated. From this it appears that 10 grains of the salt may contain 1 grain of quinidine, and still a complete solution take place; but, in this case, the quinidine will shortly begin to crystallize in a layer of ether. If more than 10 per cent. of quinidine be present, there will be found an insoluble precipitate between the strata of the fluid. If this be quinidine, it will be dissolved by the addition of ether, while *cinchonine* (*see No.* 4002) will be unaffected.

Gas. A general term applied to all aëriform or permanently elastic fluids, excepting the compound of oxygen and nitrogen constituting the atmosphere, which is distinguished from the other gaseous bodies by the name of *air*. (*See No.* 4072.) Gases for chemical purposes are usually generated in a bottle of glass or other appropriate material; or, where the application of heat is necessary, in a retort. A connecting tube of convenient shape is fitted air-tight into the neck or beak of the generating vessels, through which the gas is led into receiving vessels. These are usually bottles, with accurately fitting stoppers.

4031. Pneumatic Trough. A vessel or tank nearly filled with water, provided with a shelf placed 1 or 2 inches below the surface. The receiving bottles are first immersed in and filled with the water and then placed neck downwards on the shelf, which is furnished with holes to allow of the passage of the gas into the receivers from the connecting tube, the end of which is brought immediately under one of the holes. For gases which are easily absorbed by water, mercury or some other fluid is necessary in place of the water. As the gas ascends into the receiving bottle, the water is displaced; when full, and the gas begins to escape, the bottle should be closed with a greased stopper, and removed from the trough.

4032. To Find the Weight of a Gas. Multiply the specific gravity of the gas by 309⅛ (the weight in grains of 1000 cubic inches of air), the product will be the weight of 1000 cubic inches of the gas.

4033. To Prevent the Escape of Gas from India-Rubber Tubing. India-rubber tubing is slightly permeable to gas. The amount which escapes through the walls of the tube is very small; but it may be advisable sometimes to render an escape impossible. This can be done by giving the tubing a thin coating of a varnish made by dissolving 1½ parts molasses and 2 parts gum-arabic in 7 parts of white wine and 3½ parts strong alcohol. The molasses and gum must first be dissolved in the white wine, and the alcohol must be added very slowly, constantly stirring the mixture, or the gum will be thrown down.

4034. Oxygen. An elementary gas, colorless, tasteless, odorless, and incombustible, having a specific gravity of about 1.057. Oxygen enters largely into the composition of all nature; being a constituent part of the atmosphere (*see No.* 4072), upon which it confers the power of supporting life and combustion; and water, present more or less through the whole world, contains about 88 per cent. by weight, or 33 per cent. by volume, of oxygen; it constitutes also a portion of the majority of the mineral bodies that form the bulk of our globe. It is a powerful supporter of combustion, and its presence is essential to the existence of animal and vegetable life. Oxygen unites with certain other bodies in fixed proportions to form a class of acids distinguished as oxygen acids or *oxacids*. (*See No.* 3853.)

4035. To Obtain Oxygen Gas. Heat in a retort or flask, finely powdered chlorate of potassa, mixed with about one-fourth its weight of black oxide of manganese. The gas must be collected by attaching a tube to the flask, and passed into a receiving bottle in a pneumatic trough. (*See No.* 4031.)

Or: Take chloride of potassa, or red oxide of mercury, expose it to the heat of a spirit-lamp, in a suitable vessel, and collect the gas.

4036. Oxygen Gas from Bleaching Powder. Oxygen gas can be readily prepared by boiling bleaching powder (hypochlorite of lime) and nitrate of cobalt in a flask. Make a clear solution of the powder in water, put it into any convenient flask provided with a perforated cork and tube, and pour in a few drops of a solution of nitrate or chloride of cobalt, and set it to boil. The gas, as it is evolved, is collected in a receiving bottle. (*See No.* 4031.)

4037. To Obtain Oxygen Without Heat. According to M. Boettger, oxygen can be obtained in a very pure state by employing binoxide of barium and peroxide of lead. Take equal parts of these substances and pour on weak nitric acid; the reaction commences immediately, and the gas can be collected as usual over cold water. (*See No.* 4031.)

4038. Pure Oxygen for Inhalation. Eliot recommends for the preparation of oxygen gas, to be used in medicine, the employment of a mixture of equal parts of peroxide of barium and peroxide of lead. By pouring dilute nitric acid upon these salts, there is a violent effervescence and a copious evolution of pure oxygen gas. For greater security, the gas may be afterwards washed in water. As very little heat is necessary, the operation can be performed in any stout bottle, thus dispensing with the usual retorts. For great purity, the first portion of gas that evolves should be allowed to escape, as it contains the air which was in the apparatus.

4039. To Obtain Oxygen on the Large Scale. Nitre is exposed to a dull red heat in an iron retort or gun barrel; 1 pound of nitre thus yields about 1200 cubic inches of oxygen, slightly contaminated with nitrogen. (*Ure.*)

4040. Tests for Oxygen. It is distinguished from other gases by yielding nothing but pure water when mixed with twice its volume of hydrogen and exploded, or when a jet of hydrogen is burned in it. A recently extinguished taper, with the wick still red hot, instantly inflames when plunged into this gas. A small spiral piece of iron wire, ignited at the point and suddenly plunged into a jar of oxygen, burns with great brilliancy and rapidity.

4041. Hydrogen. A gaseous element, colorless, combustible, and the lightest of ponderable bodies, its specific gravity being only .06935. It is a constituent part (about 12 per cent. by weight, and 67 per cent. by volume) of water. According to Dumas, "it is a gaseous metal, as mercury is a liquid metal." It forms an ingredient in all bodies that possess the power of burning with flame; it burns with a pale blue flame, and, in combination with carbon, constitutes the illuminating gas in general use. In contact with spongy platinum it inflames spontaneously; and, from its extreme lightness, is the best means employed for inflating balloons. It is one of the most useful elements in the material world. Hydrogen forms, with other bodies, a class of acids called hydrogen acids or *hydracids.* (*See No.* 3853.)

4042. To Obtain Hydrogen Gas. Hydrogen gas is readily procured by pouring on fragments of zinc, in a glass bottle, or flask with a bent tube, or retort, some diluted sulphuric acid (1 measure of strong acid to 5 of water). It may be collected over water. If zinc be not at hand, fine iron wire, or the turnings or filings of iron, may be substituted for it. To procure gas of great purity, distilled zinc must be used, and it is advisable to pass the gas first through alcohol, and then through a concentrated solution of pure potassa. Care must be taken that all the air has been driven out of each vessel before any light is applied, or an explosion will ensue.

4043. Cheap Method of Obtaining Hydrogen. Take quicklime, slack it, let it cool and crumble into a dry hydrate; then mix it with charcoal, coke, or peat, and heat in a retort. The hydrate of lime (slacked lime) gives up the water that was used in slacking it, and becomes quicklime. The water is decomposed into hydrogen and carbonic acid, and these two gases can be separated by passing them through water, or the carbonic acid may be economized by employing it in the manufacture of bicarbonates. The quicklime can be again slacked and used as often as required.

4044. Hydrogen Gas for Balloons. For this purpose hydrogen may be obtained by pouring slightly diluted muriatic acid upon an equal weight of zinc, in a covered vessel having a small tap or stop-cock in the top for filling the balloons. The vessel should be made of lead, to prevent corrosion.

4045. To Estimate the Buoyant Power of Balloons. It will take about 12 cubic feet of the hydrogen gas, used for inflating balloons to balance or suspend 1 pound in the air. The rule used for balloons is as follows: The specific gravity of the gas compared with the air is .0693; 1 cubic foot of air weighs 527.04 grains, the cubic foot of gas weighs 36.93 grains; and therefore there are 527.04–36.93=490.11 grains difference between the air and gas, in one cubic foot. Multiply this difference by the number of cubic feet in the balloon, and divide by 7,000. This will give the capacity or buoyancy of the balloon, in pounds; then subtract the weight of the balloon and car.

4046. For Obtaining Hydrogen in Quantities. Place iron wire in a gun-barrel, or a porcelain tube, open at both ends, to one of which attach a retort containing water, and to the other a bent tube, connected with a pneumatic trough. The gun-barrel must now be heated to redness, and the water in the retort brought into a state of brisk ebullition, when the vapor will be decomposed, the oxygen being absorbed by the iron, and the hydrogen escaping into the gas receiver. The gas evolved may be purified, if desired, by passing it through alcohol, &c. (*See No.* 4042.)

4047. Tests For Hydrogen. Hydrogen is recognized by its combustibility; by the pale color of its flame; by producing water only when burnt in air or oxygen; by extinguishing the flame of other bodies; and by exploding when mixed with half its weight of oxygen and fired. (*Cooley.*)

4048. Carburetted Hydrogen. There are two leading gaseous compounds of carbon and hydrogen, known as carburetted hydrogen, and distinguished as light and heavy.

The light carburetted hydrogen is often abundantly disengaged in coal mines, and called *methane,* and *fire damp.* It consists of 2 equivalents of hydrogen and 1 of carbon, and burns with a yellowish flame. This gas also escapes in bubbles from the mud on the bottom of stagnant pools, combined with carbonic acid, from which it may be freed by passing through milk of lime, or a solution of caustic potassa. (*Cooley.*) It has a specific gravity of about .559. (*Fownes.*)

Heavy carburetted hydrogen is a combination of 2 equivalents of carbon and 2 of hydrogen (4 carbon and 4 hydrogen—*Booth*), and burns with a white luminous flame; it is a little lighter than air, having a specific gravity of .981. It is also called *Ethine.*

4049. To Obtain Light Carburetted Hydrogen. When 2 parts crystallized acetate of soda, 2 parts dry hydrate of potassa, and 3 parts powdered quicklime, are strongly heated in a flask or retort, this gas is abundantly evolved, and may be collected over water. (*See No.* 4031.)

4050. To Obtain Heavy Carburetted Hydrogen. Heavy carburetted hydrogen is prepared by heating in a retort 1 part of alcohol with 6 or 7 of oil of vitriol until it blackens, and conducting the mixed gases through milk of lime, which retains the sulphurous acid; and afterwards through oil of vitriol, which absorbs water, ether, and alcohol. This may also be prepared by passing the vapor of boiling alcohol through a mixture of 10 parts oil of vitriol and 3 parts water, heated to ebullition (320° to 330° Fahr.), and purifying the vapor as before.

4051. Olefiant Gas. A name given to heavy carburetted hydrogen, arising from its producing, in combination with chlorine, an oily-looking liquid. It is the presence of this gas which gives the illuminating power to *coal-gas,* which is a combination of light, heavy, and other hydrocarbons.

4052. Sulphuretted Hydrogen. A compound of hydrogen and sulphur; a colorless gas, possessing a powerful odor of rotten eggs; specific gravity 1.171; it is absorbed by water, forming liquid sulphuretted hydrogen, or hydrosulphuric acid. It is a powerful poison. Being considerably denser than air, it may be poured from its generating bottle into cavities, a scheme successfully employed by M. Thenard to destory rats in their holes, a method equally applicable to other vermin. It forms saline compounds with the alkalies, and the earths termed HYDROSULPHATES or HYDROSULPHURETS, and it precipitates metallic sulphurets from solutions of most of the metals; hence its value as a test. Air containing $\frac{1}{20000}$ part of pure hydrogen will sensibly blacken a piece of white paper, moistened with a solution of acetate of lead. Sulphuretted hydrogen is the active ingredient in the sulphurous mineral waters.

4053. To Obtain Sulphuretted Hydrogen. Mix together 2 parts of iron filings with 1 of sulphur into a thin pap with water, and heat it gently in an iron vessel. Combination takes place with the evolution of heat forming *sulphuret of iron.* Cover it till cold. On this compound, contained in a glass bottle, or other suitable apparatus, pour sulphuric acid previously diluted with 7 parts of water. If more acid be afterwards required, dilute the strong acid with only 4 of water. The resulting gas is absorbed by water, and is therefore collected, in preference, over mercury. This is the plan commonly adopted in the laboratory.

To obtain it pure, mix 1 part finely powdered tersulphuret of antimony, and 5 parts strong muriatic acid, in a small glass retort or flask: apply the heat of a spirit lamp, and collect the gas over mercury. (*See No.* 4031.)

4054. Tests for Sulphuretted Hydrogen. Sulphuretted hydrogen may be recognized by the odor, and by its blackening moist carbonate of lead, and tarnishing silver, and also by its precipitating arsenious acid yellow, tartar emetic orange, and the salts of lead black.

4055. Phosphuretted Hydrogen. This is a gaseous combination of phosphorus and hydrogen; colorless, very fetid, slightly soluble in water, and burns with a white flame. It has a specific gravity of 1.24.

4056. To Obtain Phosphuretted Hydrogen. The pure gas may be evolved by gently heating hydrated phosphorus acid in a small retort, and collecting it by a pneumatic trough. (*See No* 4031.)

The spontaneously inflammable variety of this gas is made by boiling phosphorus with solution of potash in a small retort, the beak of which is kept under water: as each bubble of gas rises from the water, it inflames, and forms a ring of white smoke, which dilates as it ascends. The spontaneous inflammability of the gas, when mixed with atmospheric air or oxygen, renders caution necessary in its preparation.

4057. Nitrogen or Azote. An elementary gaseous body. Pure nitrogen is a colorless, odorless, tasteless gas, neither combustible nor capable of supporting combustion or respiration. It is neutral to test paper, does not affect lime water, and is only slightly absorbed by pure water. Liebig places its specific gravity at 0.9722, Berzelius at 0.976.

4058. Tests for Nitrogen. It is recognized by its purely negative qualities, and by its forming nitric acid when mixed with oxygen, and exposed to the electric spark; or when a jet of hydrogen is burnt in the mixed gases. (*Cooley.*)

4059. To Obtain Nitrogen. Atmospheric air may be made to yield an unlimited supply of nitrogen, by exposing it to the action of substances which combine with its oxygen. By burning a small piece of phosphorus, placed on a capsule floating on the water in a pneumatic trough, under a large bell-glass, and allowing it to stand over the water a few hours, nearly pure nitrogen is obtained, which may be further purified by agitating it with solution of pure potassa. It may be dried by passing it through concentrated oil of vitriol.

Nitrogen may be evolved by passing chlorine gas into a solution of pure ammonia, and drying, as before, through sulphuric acid.

Another plan, well recommended, is to heat bichromate of ammonia in a retort. The evolved nitrogen is deprived of all aqueous vapor by sulphuric acid as above, or by letting it stand over fused chloride of calcium.

4060. Protoxide of Nitrogen. This gas is also called *nitrous oxide,* and is largely used by inhalation, under the name of *laughing gas,* to produce insensibility to pain. It is colorless, possesses an agreeable odor, and a sweetish taste. At 45° Fahr., and under a pressure of 50 atmospheres, it is liquid. Its specific gravity is 1.5241; it supports combustion, and is absorbed by water. Its most remarkable property is its action on the system when inspired. A few deep inspirations are usually succeeded by a pleasing state of excitement, and a strong propensity to laughter and muscular exertion, which soon subside, without being followed by languor or depression. Its effects, however, vary with different constitutions.

4061. To Prepare Laughing Gas. Evaporate a solution of nitrate of ammonia until a drop of the fused mass placed on a cold plate instantly solidifies; cool, break the lump into pieces, and place it in a stoppered bottle. For use, a portion is introduced into a glass retort, and heat applied by means of a spirit lamp. As soon as the heat reaches 480° Fahr., protoxide of nitrogen is evolved, and may be collected in bladders, gas bags, a gasometer, or in the pneumatic trough over warm water. (*See No.* 4031.) Should white fumes appear within the retort after the evolution of the gas has commenced, the heat should be lowered, as, when heated to about 600°, nitrate of ammonia explodes with violence. Nitrous oxide may also be made in the same way from crystallized nitrate of ammonia, or by exposing nitric oxide for some days over iron filings, but it requires great care in its preparation.

4062. Test for Pure Laughing Gas. When pure, it is colorless, has an agreeable odor, and does not affect a solution of nitrate of silver.

4063. Carbonic Acid. An invisible acidulous gas, formed by the union of 1 equivalent of carbon with 2 of oxygen, having a specific gravity of 1.524, and highly soluble in water. Its general properties and the methods of obtaining it will be found in Nos. 3193, &c. The application of this gas to the purposes of wine-making, &c., is given in No. 718. The methods for obtaining carbonic acid gas are given in No. 3914.

4064. Carbonic Oxide. A colorless, neutral gas, formed of equal equivalents of carbon and oxygen, and has a specific gravity of .913. It burns with a pale blue flame, and is even more poisonous than carbonic acid.

4065. To Obtain Carbonic Oxide. Carbonic oxide may be obtained from carbonic acid gas by passing the latter over fragments of charcoal heated to redness in a tube of porcelain or iron.

Also, by treating binoxalate of potassa with 5 or 6 times its weight of oil of vitriol in a glass retort, at a gentle heat.

Equal weights of chalk (or carbonate of soda) and iron filings (or charcoal), strongly heated in an iron retort or gun barrel, will evolve the gas rapidly.

Whichever way the gas is evolved, it must be passed first through a caustic alkaline solution or milk of lime, to deprive it of carbonic acid, and next over dried chloride of calcium, to deprive it of moisture. It may be collected either over mercury or water, as the latter absorbs but very little.

4066. Sulphurous Acid. This is a gaseous combination of 1 equivalent of sulphur and 2 of oxygen, having a specific gravity of 1.45, and very soluble in water, which will absorb 30 times its volume of the gas. Its properties, preparation, and application to the arts, will be found in Nos. 3864, &c.

4067. Ammonia. A highly pungent gas formed by the union of 1 equivalent of nitrogen with three of hydrogen. Its specific gravity is .589. (*See Nos.* 3981, *&c.*) Double salts of ammonia are sometimes called AMMONIURETS. Thus, sulphate or nitrate of copper precipitated in solution by ammonia, and the precipitate redissolved by an excess of ammonia, may be called ammoniurets of copper, but more correctly ammonio-sulphate, or ammonio-nitrate of copper.

4068. Hydrochloric Acid. A gaseous acid formed of equal equivalents of hydrogen and chlorine. (*See Nos.* 3882, *&c.*)

4069. Chlorine. An elementary gas, of a yellowish green color, a pungent, suffocating odor, and an astringent taste. Its specific gravity is 2.47. Under a pressure of 4 atmospheres it condenses into a yellow limpid liquid. Its most remarkable properties are its power of destroying almost all animal and vegetable color, and the putrid odor of decomposing organic matter. It has a very strong attraction for metals. With bases chlorine forms CHLORIDES or CHLORURETS. (*See No.* 3853.)

4070. To Obtain Chlorine. This gas is obtained, for laboratory use, &c., by mixing together in a glass flask or retort, strong muriatic acid with half of its weight of finely-powdered peroxide of manganese. Or: Pour common muriatic acid, diluted with an equal weight of water, upon half its weight of chloride of lime. Chlorine gas is immediately evolved even in the cold, but much more rapidly on the application of a gentle heat. This gas must be collected in clean dry bottles by displacement. The tube conducting the gas must reach to the bottom of the bottle, when the chlorine, being heavier than the air, will displace the latter, without mixing with it. The bottle is known to be full by the gas overflowing the mouth, which is easily perceived by its green color. The bottle must now be closed up with an accurately fitting stopper, previously greased, and an empty one put in its place, which is subsequently treated in like manner. To free the gas entirely from muriatic acid, it may be passed through water; and to render it dry, it may be passed over dry chloride of calcium. Chlorine gas may also be collected over a saturated solution of common salt in the pneumatic trough, if the presence of moisture be no objection. (*See No.* 4031.)

4071. Tests for Chlorine. This gas is readily distinguished from other gases by its color, odor, and bleaching properties. Its aqueous solution dissolves gold leaf, and instantly blackens a piece of silver plunged into it. It rapidly destroys the color of iodide of starch, solution of indigo, litmus, and turmeric. A simple method of detecting free chlorine is to hold a rod, dipped in water of ammonia, over it, when white fumes of sal-ammoniac will be formed; this, coupled with the property of bleaching colors, may, in most cases, be taken as evidence of the presence of this substance.

4072. Air. The air or atmosphere which surrounds the earth is a mixture (not combination—*Fownes*) of 77 parts by weight (or 79.19 parts by measure) of nitrogen, and 23 parts by weight (or 20.81 by measure) of oxygen. It usually contains also a variable amount of moisture, a very small proportion of carbonic acid, a trace of ammonia, and sometimes of carburetted hydrogen; these last are found incidentally in the air, in a variable degree. It is the standard in the comparative or specific gravity of gaseous bodies. (*See No.* 47.) At 60° Fahr., and with the barometer at 30 inches, 100 cubic inches of air weigh 30.935 grains; and water (the standard of specific gravity for fluids) weighs just 816 times as much as air.

4073. Tests for Pure Air. A simple method of ascertaining the presence of impurity (carbonic acid) in the atmosphere, is to nearly fill a glass tumbler with limewater, and to place it in any convenient position, as on the mantelpiece of a room. The rapidity with which a pellicle forms on its surface, or the water becomes cloudy, corresponds to the amount of the carbonic acid present in the atmosphere that surrounds it.

A little moist carbonate of lead put on a plate or saucer, and exposed in the same way, will turn black, should any sulphuretted hydrogen be contained in the air. This is a very delicate test for that destructive gas.

Miscellaneous Chemicals.

It is proposed, in this place, to give a concise description of the chemical compounds referred to in the various departments of this book. A complete list of chemicals would not be necessary for the scope of the work, which is a purely practical one; such information only is therefore given as is deemed necessary to render the whole thoroughly intelligible, and as complete as possible. A considerable number of them are inserted, for the sake of clearness, in connection with the process or special purpose for which their use is directed. These will be found in their proper place by reference to the INDEX.

4075. Chloride of Gold. Gold unites with chlorine under two different proportions, and are distinguished as the *protochloride* and the *terchloride* of gold.

The terchloride of gold, or *auric chloride*, consists of 3 equivalents of chlorine and 1 of gold, and is obtained by dissolving 1 part gold in 3 parts nitro-muriatic acid (aqua-regia); evaporate until vapors of chlorine begin to be disengaged, and then set the solution aside to crystallize. It forms orange-red crystalline needles, or ruby-red prismatic crystals; is deliquescent, and soluble in water, ether, and alcohol, forming a deep yellow solution. (*Cooley.*)

The protochloride of gold, or *aurous chloride*, consists of 1 equivalent each of chlorine and gold, and is obtained by evaporating the terchloride to dryness and exposing it to a heat of 450° (440° *Fownes*) Fahr., until chlorine ceases to be evolved. It forms a yellowish-white mass, insoluble in water; but it is decomposed by water, slowly when cold, and rapidly by the aid of heat, into metallic gold and terchloride of gold. (*Cooley.*)

4076. Tests for the Presence of Gold in Solutions. Protosulphate of iron gives a brown precipitate, which acquires a metallic lustre when rubbed.

Protochloride of tin (preferably containing a little perchloride) gives a violet, purple, or blackish precipitate, insoluble in muriatic acid.

Sulphuretted hydrogen and hydrosulphuret of ammonia give a black precipitate, insoluble in simple acids.

Ammonia gives a reddish-yellow precipitate (fulminating gold) with tolerably concentrated solutions, either at once, or on boiling the liquid.

Liquor of potassa gives, with neutral solutions of gold, a similar precipitate to that formed by ammonia, insoluble in excess.

4077. Fused Nitrate of Silver. Take 3 ounces refined silver, 2 fluid ounces nitric acid, and 5 fluid ounces distilled water; mix in a glass flask and apply a gentle heat until the metal is dissolved. Transfer the solution to a porcelain capsule or crucible, decanting it off a heavy black powder which appears at the bottom of the flask; evaporate the solution to dryness; raise the heat, in a dark room, until the mass liquefies, then pour it into hinged brass or iron moulds furnished with cylindrical cavities of the size of a goose-quill. Keep the product, which is *Lunar Caustic*, or *fused nitrate of silver*, in well stopped bottles, impervious to the light.

Crystallized (or crystals of) *Nitrate of Silver* is obtained by dissolving grain silver (*see No.* 3217) in nitric acid diluted with twice its weight of water; evaporating the solution until it will crystallize on cooling very slowly. (*See No.* 3216.)

4078. Oxide of Silver. Dissolve 2 parts nitrate of silver, and 1 part hydrate of potassa, each separately, in distilled water; mix the solution, and, after frequent agitation during an hour, collect and wash the precipitate, and dry it by a gentle heat in the shade. This is more strictly the *protoxide of silver*, and is in the form of a pale brown powder.

4079. To Reduce Solid Silver from its Chloride. Mix together the dry chloride of silver in ⅛ its weight of powdered black resin; heat moderately in a crucible until the flame ceases to have a greenish blue color; then increase the heat suddenly until the silver fuses into a button at the bottom of the crucible. Some parties recommend an addition of a little powdered calcined borax, sprinkled on the surface before increasing the heat. (*See No.* 3214.)

4080. To Prepare Nitrate of Silver from an Alloy of Silver and Copper. Palm's method. When it is desired to prepare nitrate of silver from silver containing copper—coins for example—filter the nitric acid solution, dissolve the alloy in nitric acid, evaporate it nearly to the consistence of oil, not to dryness, and add to a part of this concentrated metallic solution, ¾ part of nitric acid free from chlorine. The silver salt precipitates in the form of crystals and the copper remains in the solution. Wash the precipitate 2 or 3 times with concentrated nitric acid, and evaporate to dryness. The more concentrated the nitric acid, the more completely is the silver salt precipitated; an acid of 1.250 specific gravity is sufficient, however, to separate completely the two metals. (*See No.* 3216.)

4081. Sulphate of Silver. Prepared by dissolving silver in sulphuric acid containing one-tenth of nitric acid; or by precipitating a solution of the nitrate by another of sulphate of soda. It dissolves in 80 parts of hot water, and falls in small needles as the solution cools. (*Cooley*). According to Fownes it dissolves in 88 parts boiling water.

4082. Sulphuret of Silver. A greyish-black substance prepared by passing sulphuretted hydrogen gas through a solution of nitrate of silver. It may also be obtained by melting sulphur and silver together.

4083. Tests for Silver in Solution. Silver is entirely soluble in diluted nitric acid. This solution, treated with an excess of muriate of soda, gives a white precipitate entirely soluble in ammonia water, and a fluid which is not affected by sulphuretted hydrogen. The nitric solution of silver also gives a white curdy precipitate (chloride of silver) with muriatic acid, soluble in ammonia and insoluble in nitric acid, and blackened by exposure to light. It gives white precipitates with solutions of the alkaline carbonates, oxalates, and prussiates. It gives yellow precipitates with the alkaline arsenites and phosphates. With the arseniates, red precipitates. With the fixed alkalies, brown precipitates. With sulphuretted hydrogen, a black powder. With phosphorus and metallic copper or zinc, a precipitate consisting of pure silver.

4084. Chloride of Platinum. The commercial chloride of platinum is the *bichloride,* formed by dissolving platinum in nitro-muriatic acid (aqua-regia), and evaporating the solution to dryness at a gentle heat. It is reddish-brown, deliquescent, and very soluble in water and in alcohol, yielding orange-colored solutions. (*Cooley.*) (*See No.* 3220.)

4085. Protochloride of Platinum. This is formed by exposing the dried and powdered bichloride (*see No.* 4084) for some time to a temperature of 450° Fahr. It is a greenish-grey, powder, insoluble in water, but soluble in muriatic acid.

4086. Ammonio-Chloride of Platinum. A solution of sal-ammoniac is added to a strong solution of bichloride of platinum (*see No* 4084), avoiding excess; the precipitate is collected on a filter, washed with a little weak alcohol, and dried at a heat not exceeding 180° Fahr. It consists of minute, transparent, yellow crystals, very feebly soluble in water, less so in dilute alcohol, and insoluble in acids. By heating to redness, it is converted into spongy platinum. (*See No.* 3336.)

4087. Tests for Solutions of Platinum. Sulphuretted hydrogen throws down from neutral and acid solutions of platinum, a blackish-brown precipitate, which is only formed after a time in the cold, but immediately on heating the liquid. Sal-ammoniac and chloride of potassium give yellow crystalline precipitates, insoluble in acids, but soluble in excess of the precipitant, upon the application of heat, and decomposable by heat, with production of spongy platinum. Ammonia and potassa also give similar precipitates in solutions previously acidulated with hydrochloric acid. (*Cooley*).

4088. Subacetate of Copper. A green or bluish-green powder, better known as *verdigris.* This may be made by spreading the marc of grapes, or pieces of cloth dipped in crude acetic acid, upon plates of copper, with exposure to the air for several weeks. (*Fownes.*)

4089. Binacetate of Copper. Verdigris, dissolved in vinegar with the aid of heat, forms dark green or blue crystals of binacetate of copper. This is the commercial *acetate of copper.*

4090. Ammonio-Sulphate of Copper. A dark blue pulverulent substance, formed by rubbing together 1 ounce sulphate of coppper and ½ ounce sesquicarbonate of ammonia, until carbonic acid ceases to be evolved; then drying the product, wrapped in bibulous paper, in the air.

4091. Nitrate of Copper. This consists of deep blue, very deliquescent crystals, obtained by dissolving pure copper in dilute nitric acid. (*See No.* 97.)

4092. Protoxide of Copper—also known as *black oxide of copper*—may be formed by calcining metallic copper, nitrate of copper, or the hydrate, thrown down from solutions of the salts of copper by means of pure potassa. This preparation was formerly called the deutoxide of copper. It is not changed by heat, but readily gives out its oxygen when heated with combustible matter; hence its general use in organic analysis for supplying oxygen. It communicates a beautiful green color to glass and enamels.

4093. Sulphite of Copper. To a concentrated solution of bisulphite of potash add a cold solution of sulphate of copper, filter, and heat gently.

4094. Suboxide of Copper. This is the *red oxide of copper,* obtained by heating together in a covered crucible 4 parts copper filings, and 5 parts black oxide of copper. (*See No.* 4092.) Or: Mix 100 parts sulphate of copper with 57 parts carbonate of soda, (both in crystals), and fuse them at a gentle heat; cool, pulverize, add 25 parts fine copper filings, ram the mixture into a crucible, cover it over, and expose it for 20 minutes to a white heat. It consists of a superb red powder with a metallic lustre. It is used as a pigment and a bronze, and as a stain for glass and enamel, to which it gives a rich red color. Heat converts it into the black oxide. With ammonia it forms a colorless solution, which rapidly becomes blue from the action of the air. (*Cooley.*)

4095. Peroxide of Copper. An oxide formed by the action of peroxide of hydrogen water on the hydrated black oxide.

4096. Sulphate of Copper. The *blue vitriol* of commerce is obtained from the native sulphuret of copper (copper pyrites). Pure sulphate of copper is made by the direct solution of the metal, or preferably, of its oxide or carbonate, in sulphuric acid. It consists of fine blue crystals, slightly efflorescent in the air. By heat it loses its water of crystallization and crumbles into a white powder. (*See No.* 120.)

4097. Chloride of Copper. Dissolve black oxide of copper in muriatic acid; evaporate and crystallize. It forms green, deliquescent crystals, soluble in alcohol, the flame of which it turns green; exposed to a heat under 400° Fahr. it becomes anhydrous, assuming the form of a yellow powder.

4098. Ferrocyanide of Copper. Called also *Prussiate of Copper.* Precipitate a solution of a salt of copper (sulphate of copper, for instance,) with another of yellow prussiate of potash; collect the powder, wash it with water, and dry. Has a beautiful reddish-brown color, and is sometimes used as a pigment.

4099. Tests for Copper Solutions. The solutions of copper possess a blue or green color, which they retain, even when considerably diluted with water.

With caustic potassa they give a light blue bulky precipitate, turning blackish-brown or black on boiling the liquid.

Ammonia and carbonate of ammonia produce a bluish-white precipitate, soluble in excess of ammonia, yielding a rich deep blue solution.

The carbonates of potassa give a similar precipitate to the last, but insoluble in excess of the precipitate.

Ferrocyanide of potassium gives a reddish-brown precipitate. Sulphuretted hydrogen and hydrosulphuret of ammonia give a blackish-brown or black one.

A polished rod of iron, on inmersion in an acidulated solution, quickly becomes coated with metallic copper.

4100. Delicate Test for Iron and Copper. The alcohol tincture of logwood will produce a blue or bluish-black tint in water which has been run through iron or copper pipes, when neither tincture of galls, sulphocyanide, nor the ferrid and ferrocyanides of potassium show any reaction.

4101. Acetate of Lead. Acetate of lead should be completely soluble in distilled water, and when the lead is exactly precipitated with dilute sulphuric acid, or by sulphuretted hydrogen, the clear supernatant liquid should be wholly volatilized by heat without residue. Sulphuric acid poured on acetate of lead evolves acetic vapors. Acetate of lead is powerfully astringent. Take 4 pounds 2 ounces oxide of lead (litharge), acetic acid (specific gravity 1.048), and distilled water, of each 4 pints; mix the fluids, add the oxide, dissolved by a gentle heat, strain, evaporate, and crystallize. On the large scale it is usually prepared by gradually sprinkling oxide of lead into strong vinegar, heated in a copper boiler rendered negative-electric by having a large flat piece of leat soldered within it, constant stirring being employed until the acid is saturated, when the mother liquors of a former process may be added, the whole heated to the boiling point, allowed to settle till cold, decanted, evaporated to about the specific gravity 1.266 or 1.267, and then run into salt-glazed stoneware vessels to crystallize. The best proportions are, finely powdered litharge 13 parts, and acetic acid specific gravity 1.0482 to 1.0484, 23 parts. These ingredients should produce about 38½ parts of crystallized sugar of lead. A very slight excess of acid should be preserved in the liquid during the boiling and crystallization, to prevent the formation of any basic acetate, which would impede the formation of regular crystals.

4102. Chloride of Lead. This is a white crystalline powder, called also *muriate of lead.* Precipitate a solution of 19 ounces acetate of lead in 3 pints boiling distilled water, with a solution of 6 ounces chloride of sodium in 1 pint boiling water; when cold, wash and dry the precipitate. It may be obtained in brilliant colorless needle-shaped crystals, by dissolving finely powdered litharge in boiling dilute hydrochloric acid. Filter while hot, and the crystals form on cooling.

4103. Iodide of Lead. Acetate of lead, 9 ounces; water, 6 pints; dissolve; iodide of potassium (pure), 7 ounces; water, 2 pints; dissolve. Add the latter solution to the former, wash and dry the precipitate, and keep it from the light. Or: Iodide of potassium and nitate of lead, of each 1 ounce; dissolve each separately in ¾ pint of water, mix, collect the precipitate in a muslin or linen filter, and wash it with water; then boil it in 3 gallons water, soured with pyroligneous (acetic) acid, 3 fluid ounces; let the solution settle (still keeping the liquid near the boiling point), and decant the clear; as the water cools, the iodide will subside in brilliant golden yellow lamellæ, or minute crystals.

The latter is the best process, as any adhering oxide of lead is dissolved out by the acid. (*Cooley*).

4104. Chromate of Lead. To a filtered solution of acetate or nitrate of lead, add a filtered solution of chromate of potassa, as long as a precipitate forms, which is collected, washed with water, and dried. This forms *chrome-yellow.* (*See No.* 2705.)

4105. Dichromate of Lead. Boil pure carbonate of lead with chromate of potassa in excess, until it assumes a proper red color; then wash it with pure water, and dry it in the shade. This is the pigment known as *chrome-red.* (*See No.* 2706.)

4106. Litharge. Litharge is an oxide of lead prepared by scraping off the dross that forms on the surface of melted lead exposed to a current of air (dross of lead), and heating it to a full red, to melt out any undecomposed metal. The fused oxide in cooling forms a yellow or reddish semi-crystalline mass, which readily separates into scales; these, when ground, constitute the powdered litharge of commerce. Litharge is also prepared by exposing red lead to a heat sufficiently high to fuse it, and English litharge is obtained as a secondary product by liquefaction, from argentiferous lead ore. The litharge of commerce is distinguished by its color into *litharge of gold,* which is dark colored and impure, and *litharge of silver,* which is purer, and paler colored. The dark color of the former is chiefly owing to the presence of red lead. In grinding litharge, about 1 pound of olive oil is usually added to each 1 cwt., to prevent dust. Litharge is employed in pharmacy, to make plasters and several other preparations of lead; by painters as a dryer for oils, and for various other purposes in the arts.

4107. Nitrate of Lead. Litharge, 4½ ounces; diluted nitric acid, 1 pint; dissolve by a gentle heat, and set the solution aside to crystallize. Employed as external application in cutaneous affections, &c. A very weak solution is an excellent remedy for chapped hands, &c.

4108. Tests for the Presence of Lead in its Solutions. The presence of lead in solutions may be recognized by the effects produced by the following reagents:

The addition of sulphuretted hydrogen, hydrosulphuret of ammonia, or the alkaline sulphurets, to a solution containing lead, give black precipitates, insoluble in cold dilute acids, alkalies, alkaline sulphurets, and cyanide of potassium.

Caustic potassa or soda gives a white precipitate, soluble in excess of the precipitant.

Ammonia throws down a white precipitate, insoluble in excess, from all the solutions of lead salts, except that of the acetate.

Dilute sulphuric acid, in excess, also solutions of the sulphates, give a white precipitate, insoluble in dilute nitric acid, but soluble in a solution of potassa.

Chromate of potassa gives a yellow precipitate, whose soluble qualities are the same as that from sulphuric acid last mentioned.

Iodide of potassium gives a yellow precipitate, soluble in acetic acid, a solution of potassa, alcohol, and boiling water; from boiling water it is deposited in small, brilliant, golden-yellow scales, as the liquid cools. (*See also Nos.* 2694, &c.)

4109. To Prepare Chloride of Zinc. Dilute 1 pint hydrochloric acid with 1 quart water, add to it 7 ounces zinc in small pieces; when the effervescence is nearly finished, apply heat until bubbles cease to be evolved; decant the clear and evaporate to dryness. Fuse the product in a lightly covered crucible, by a red heat; pour it out on a flat, smooth stone, and, when cold, break it into small pieces, and preserve it in a well-stoppered bottle.

4110. Ammonio-Chloride of Zinc. By dissolving 68 parts chloride of zinc and 54 parts sal-ammoniac, a crystallizable salt is formed, which dissolves oxides of copper and of iron, and is useful in tinning or zincing those metals.

4111. Chloride of Zinc. Dissolve 2½ troy ounces zinc in small pieces, in sufficient muriatic acid; strain the solution, add 60 grains nitric acid, and evaporate to dryness. Dissolve the mass in 5 fluid ounces water, add 60 grains chalk, and let the mixture stand for 24 hours; then filter, and evaporate to dryness. Lastly, fuse the dry mass, pour it out on a flat stone, and, when it has congealed, break the mass in pieces and keep in a well-stoppered bottle. (*U. S. Disp.*)

4112. Precipitated Carbonate of Zinc. Take 12 troy ounces each sulphate of zinc and carbonate of soda; dissolve each separately in 4 pints water; mix the solutions and let the powder subside; pour off the liquid, wash the precipitate with hot water until the washings are nearly tasteless, and dry with a gentle heat. (*U. S. Ph.*)

4113. Tutty Powder. Impure oxide of zinc. It is a substance which collects in the chimneys of the furnaces in which the ores of zinc are smelted.

4114. To Prepare Pure Sulphate of Zinc. Mix 4 ounces laminated or granulated zinc with 3 fluid ounces oil of vitriol, and 1 pint water, in a porcelain capsule, and when gas ceases to be evolved, boil for 10 minutes, filter through muslin, and evaporate to dryness; next dissolve it in 1 pint water, agitate this solution frequently during 6 hours with ¼ ounce prepared chalk, and filter it; add to the filtered solution 1 fluid drachm each commercial nitric acid and dilute sulphuric acid; evaporate the mixture until a pellicle forms on the surface, and set it aside to crystallize; dry the crystals on bibulous paper without heat, and preserve them in a bottle. The mother liquor will yield more crystals by further evaporation. This substance is als known as *white vitriol.*

4115. Cyanide of Zinc. Add a solution of cyanide of potassium to a solution of pure sulphate of zinc; wash and dry the precipitate.

4116. Flowers of Zinc. This is obtained by the rapid combustion of zinc in a deep crucible, placed sideways in a furnace, so that the flowers (oxide of zinc) may be collected as they form.

4117. Oxide of Zinc. Place carbonate of zinc in a covered clay crucible, and expose to a very low red heat, until a portion taken from the centre of the mass ceases to effervesce on being dropped into dilute sulphuric acid. This is the commercial zinc-white. (*See No.* 2696.)

4118. Tests for the Solutions of Zinc. The solutions of zinc are precipitated white by the pure alkalies and carbonate of ammonia, but are completely redissolved by excess of the precipitant. The carbonates of potassa and soda give a permanent white precipitate of carbonate of zinc. Hydrosulphuret of ammonia also gives a white precipitate, and so does sulphuretted hydrogen when the solution is quite neutral. Prussiate of potash gives a gelatinous white, or bluish-white precipitate.

4119. Protoxide of Tin. Usually termed *oxide of tin.* Precipitate a solution of protochloride of tin with carbonate of potassa, wash and dry the powder at a heat under 166° Fahr., with as little exposure to the air as possible. It is a white or greyish-white powder, soluble in acids and in the pure fixed alkalies. If it be heated in an atmosphere of carbonic acid it loses its water and changes to a dense black powder, which is anhydrous protoxide. (*Cooley.*)

4120. Sesquioxide of Tin. A grey, slimy precipitate, soluble in muriatic acid, and in ammonia, obtained by mixing fresh, moist hydrated peroxide of iron with a solution of the neutral protochloride of tin. (*Fuchs*).

4121. Binoxide or Peroxide of Tin. Obtained by adding potassa, or an alkaline carbonate, to a solution of perchloride of tin. This substance is also known as *Stannic acid;* hence, its compounds with alkalies are sometimes called STANNATES. It is soluble in acids, and in pure alkalies. If grain tin be heated in a test tube with nitric acid, the tin is converted, with evolution of yellow fumes, into a white powder, peroxide of tin. The nitric acid will convert the tin into an oxide, but it cannot combine with the oxide produced. (*Stöckhardt.*) From this it appears that *nitrate of tin* is a misnomer.

4122. Tin or Polishers' Putty. Melt tin with rather more than an equal quantity of lead, then rapidly raise the heat till the mixture is red hot; the tin will then be thrown off in dross, which should be removed as it forms. This dross is the *peroxide of tin*, or tin putty; the dross may be calcined until it becomes whitish, and then reduced to powder.

4123. Protochloride of Tin. *Muriate of tin* is obtained by distilling a mixture of chloride of mercury and tin in fine powder. It is grey, solid, resin-like, fusible, and volatile. (*Cooley.*)

4124. Perchloride of Tin. Called also *Bichloride* and *Permuriate of Tin.* The pure bichloride is obtained by heating the protochloride in chlorine gas, or by distilling a mixture of 8 parts of grain tin with 24 parts of corrosive sublimate, when a very volatile, colorless liquid comes over, which was formerly called *Libavius' fuming liquor.* A solution of the bichloride or permuriate of tin is obtained by dissolving tin in nitromuriatic acid. This solution is much used by dyers, under the name of Spirits of Tin, Dyers' Spirits, &c. (*See Nos.* 107, *&c.*) For this purpose, the acid is best made by mixing 2 parts of muriatic acid with 1 part each of nitric acid and water, all by measure. (*Liebig*). The tin should be added by degrees, one portion being allowed to dissolve before adding another; as, without this precaution, the action is apt to become violent, the temperature rise, and peroxide of tin to be deposited. (*See No.* 108.) A process which has been highly recommended, is to prepare a simple solution of the protochloride, and to convert it into the bichloride, either by the addition of nitric acid and a gentle heat, or by passing chlorine through it.

4125. Tests for the Salts of Tin. The salts of tin are characterized by the following general properties: Ferroprussiate of potash gives a white precipitate. Hydrosulphuret of potash, a brown-black with the protoxide, and a golden-yellow with the peroxide. Galls do not affect the solutions of these salts. Corrosive sublimate occasions a black precipitate with the protoxide salts; a white with the peroxide. A plate of lead frequently throws down metallic tin, or its oxide, from the saline solutions. Chloride of gold gives, with the protoxide solutions, the purple precipitate of Cassius. Chloride of platinum occasions an orange precipitate with the protoxide salts. (*Cooley.*)

4126. Ethiops of Antimony. Triturate together 3 parts sulphuret of antimony, and 2 parts black sulphuret of mercury.

4127. Flowers of Antimony. Throw powdered sulphuret of antimony, by spoonfuls, into an ignited tubulated retort that has a short and very wide neck, until as many flowers collect in the receiver as are required.

The *argentine flowers* are thus prepared: Keep metallic antimony melted in a vessel, freely exposed to the air, and furnished with a cool place for the flowers to rest upon; collect the flowers as deposited. According to Berzelius, these are sesquioxide of mercury.

4128. Liver of Antimony. Melt together 1 part sulphuret of antimony, and 2 parts dry carbonate of soda (or potash), and heat until it acquires a proper color; then cool and powder it. *Crocus of antimony* is sometimes sold for the above, but the latter is prepared by deflagrating equal parts of antimony and saltpetre (nitrate of potassa), a small portion at a time, and the fused mass, separated from the dross, reduced to fine powder. (*Cooley.*)

4129. Potassio-Tartrate of Antimony. Commercial *Tartar Emetic.* Take 2 troy ounces oxide of antimony, and 2½ troy ounces bitartrate of potassa, both in very fine powder; mix them together, and add them to 18 fluid ounces boiling distilled water in a glass vessel. Boil for 1 hour, filter while hot, and set aside to crystallize. Dry the crystals, and keep in a well-stoppered bottle. By further evaporation the mother-water will yield more crystals, which should be purified by a second crystallization. (*U. S. Ph.*)

4130. Oxide of Antimony. Insert 4 troy ounces sulphuret of antimony in very fine powder into a quart flask; add 18 troy ounces muriatic acid, and digest in a sand-bath until effervescence ceases. Then remove the bath and add 600 grains nitric acid, and when nitrous fumes cease to be given off, and the liquid has grown cold, add it to ½ pint water, and filter. Pour the filtrate gradually into 12 pints water, constantly stirring, and wash the precipitate twice by decantation, using each time spirits water; drain it through muslin, and then wash it with water until the washings cease to have an acid reaction. Add 1½ fluid ounces water of ammonia, and, after standing 2 hours, filter through wet muslin, and wash with distilled water as long as the washings form a precipitate with nitrate of silver. Then dry with a gentle heat on bibulous paper. (*U. S. Ph.*) A greyish-white powder, insoluble in water, soluble in muriatic and tartaric acids.

4131. Butter of Antimony. The liquid *chloride of antimony*, commercially known by this name, is usually made by dissolving crude or roasted black antimony in muriatic acid with the addition of a little nitric acid. It usually contains pernitrate of iron.

4132. Sulphuret of Antimony. The black sulphuret (*tersulphuret*) of antimony is prepared from commercial sulphuret of antimony or by elutriation, in the same manner as directed for prepared chalk. (*See No.* 1292.) The *commercial sulphuret* is obtained from the native gray antimony ore by fusion; this separates the sulphuret from the less fusible earthy matter; it is then run into cakes. (*Cooley.*)

Mixtures of an acidulated menstruum or syrup with a sulphuret of antimony, are apt to disengage sulphuretted hydrogen, when there is much of them, if kept in a warm room. The rule should be to prepare as small a quantity as possible, and to keep the bottle cool. (*Eymael.*)

4133. Penta-Sulphuret of Antimony. Called also *golden sulphuret of antimony.* Boil together for some hours 72 parts tersulphuret of antimony, 68 parts dry carbonate of soda, 52 parts fresh hydrate of lime, and 13 parts sulphur; filter, evaporate, and crystallize. Redissolve the crystals (*Schlippe's salt*), add dilute sulphuric acid, collect the golden floculent precipitate, wash it with cold distilled water, and dry with a gentle heat. (*Liebig.*)

4134. Nitrate of Bismuth. The *neutral nitrate* is made from 2 ounces pure bismuth broken into fragments, dissolved by heat in 6 ounces nitric acid, adding more acid, if necessary, to effect entire solution. Add to the solution half its volume of distilled water, filter through powdered glass, and crystallize by evaporation. (*Cooley.*)

4135. Subnitrate of Bismuth. This is also called *trisnitrate of bismuth, magistery of bismuth*, and *pearl white.* It is insoluble in water, but freely soluble in nitric acid. Dissolve 2 ounces bismuth in 3 fluid ounces nitric acid, previously diluted with 2 fluid ounces distilled water; then add 3 quarts cold water, and allow the white precipitate to subside. Afterwards decant the clear liquor, wash the powder, and dry it by a gentle heat. (*Br. Ph.*)

4136. Oxide of Bismuth. The *anhydrous oxide* is made by exposing the nitrate or subnitrate to gentle ignition in a crucible. This is a straw-yellow colored powder. The *hydrated oxide* is a rich-looking white powder, obtained thus: Dissolve 2 pounds bismuth in 2½ pounds nitric acid, and drop it gradually into a solution of 3 pounds carbonate of potassa in twice it weight of water, rendered caustic by previous treatment with quicklime (*see No.* 101); wash the precipitate well with cold water.

4137. Tests for the Salts of Bismuth. Tin, copper, iron, and zinc throw down bismuth from its solutions in the metallic state. If a salt of bismuth be heated with carbonate of soda by the flame of a blowpipe, a bead of the metal, surrounded by a crust of yellow oxide, is obtained. The brittleness of the bead under the hammer distinguishes it from lead. The salts of bismuth are mostly devoid of color; some are soluble, others insoluble. The soluble salts redden litmus paper; and, when the solution contains but little free acid, and is largely diluted with water, a subsalt, more or less soluble, is deposited. This property of forming subsalts is very characteristic. (*Makins.*)

4138. Chloride of Mercury. This preparation is usually known as *calomel.* Boil, by means of a sand-bath, 24 troy ounces mercury with 36 troy ounces sulphuric acid, until a dry white mass is left. Rub this, when cold, with 24 ounces mercury in an earthenware mortar until thoroughly mixed; add 18 troy ounces chloride of sodium, triturate until the globules of mercury cease to appear, and sublime the mixture. Reduce the sublimate to a very fine powder and wash it with boiling distilled water until the washings afford no precipitate with water of ammonia, and dry it. (*U. S. Ph.*)

4139. Bichloride of Mercury. The *corrosive sublimate* of the drug stores. Boil 24 troy ounces mercury in 36 troy ounces sulphuric acid, by means of a sand-bath. When cold, rub the dry white mass with 18 troy ounces chloride of sodium in an earthenware mortar; then sublime with a gentle heat. (*U. S. Ph.*)

4140. White Precipitate. This is the *ammonio-chloride of mercury,* and is prepared by dissolving, with heat, 6 ounces bichloride of mercury (corrosive sublimate) in 3 quarts distilled water; when cool, add 8 fluid ounces liquor of ammonia, frequently shaking it. Wash the precipitate with water, and dry it. It is used to make an ointment for skin diseases; also to destroy small vermin.

4141. Red Precipitate. *Red oxide* or *binoxide of mercury* is now used in medicine as an escharotic, also to induce salivation. Dissolve 4 ounces bichloride of mercury in 6 pints water; add 28 fluid ounces liquor of ammonia; wash the precipitate in distilled water, and dry by a gentle heat.

4142. Chloride of Mercury and Ammonia. This is obtained by triturating together equal parts of bichloride of mercury and sal-ammoniac. This addition of sal-ammoniac renders the corrosive sublimate more soluble in water, for use in lotions and injections.

4143. Black Precipitate. *Protoxide of mercury* is obtained by agitating together 1 ounce calomel with 1 gallon lime-water; decanting the clear liquid after subsidence, and washing the sediment with distilled water, after which it is dried on bibulous paper.

4144. Protonitrate of Mercury. Mix together in a wide-bottomed glass vessel, equal parts of quicksilver and nitric acid (specific gravity 1.32); after digestion for 24 hours in a cool place, remove the crystals that have formed, wash them with a little nitric acid, drain them, and keep from the air in a stoppered bottle. (*Paris Codex.*)

4145. Tests for the Salts of Mercury. The salts of mercury are all volatilized at a dull red heat—give a white precipitate with prussiate of potash, a black one with sulphuretted hydrogen and hydrosulphurets, an orange-yellow one with gallic acid, and with a plate of polished copper, a white coat of metallic mercury.

Solutions of the protosalts of mercury yield a grey or black precipitate with alkalies, a yellowish or greenish-yellow one with iodide of potassium, a white one with muriate of soda.

Solutions of the persalts of mercury yield with caustic alkalies, yellowish or red precipitates; with alkaline carbonates, a brick-red one; with iodide of potassium, a scarlet one.

4146. Sulphate of Iron. Commercial sulphate of iron is known also as *Copperas, Green Vitriol, Shoemakers' Black, &c.* For medicinal purposes it requires some preparation: Mix 1 fluid ounce sulphuric acid with 4 pints water; add 4 pounds commercial sulphate of iron, and 1 ounce iron wire; digest with heat and occasional agitation until the sulphate is dissolved; strain while hot, and set aside so that crystals may form; evaporate the mother-liquor for more crystals, and dry the whole. (*Cooley.*)

4147. Sulphuret of Iron. Mix together 4 parts sublimed sulphur, and 7 parts iron filings. Heat in a crucible in a common fire till the mixture begins to glow; then remove the crucible from the fire, and cover it up until the reaction is at an end and the whole has become cold.

4148. Bisulphuret of Iron. This is found in large quantities in mineral form, and is known as *Iron pyrites.* It may also be obtained by projecting a mixture of 5 parts sulphur, and 4 parts iron filings, into a red-hot crucible, excluding the air as much as possible. It melts easily, and takes sharp casts, and may be colored red with vermilion.

4149. Hydrated Protosulphuret of Iron. This is a black, insoluble substance, rapidly decomposed by exposure to the air. A neutral solution of protosulphate of iron made with recently boiled or distilled water, is precipitated by adding a solution of hydrosulphuret of ammonia, or of sulphuret of potassium. Collect the precipitate on a filter, wash it as quickly as possible with recently boiled water, squeeze in a linen cloth, and preserve in its pasty state under water.

This preparation of iron is proposed by Mialhe as an antidote to the salts of arsenic, antimony, bismuth, lead, mercury, &c., and to arsenious acid, more especially to white arsenic and corrosive sublimate. On contact with the latter substance it is instantly converted into protochloride of iron and sulphuret of mercury, two comparatively inert substances.

4150. Hydrated Persulphuret of Iron. Prepared by adding, very gradually, a diluted solution of sulphuret of potassium, or of hydrosulphuret of ammonia, to a neutral solution of persulphate of iron, collecting, &c., the precipitate, in the same way as in hydrated protosulphuret of iron. Bouchardat and Sandras recommend this persulphuret as a substitute for the protosulphuret, to which, they say, it is preferable.

4151. Protoxide of Iron. Dry protoxide of iron is a black powder; in its hydrated state it is white, and when exposed to the air rapidly absorbs oxygen, assuming first a greyish-green color, and then a brownish-red, which is much brightened by exposure to a red heat, at the same time that its solubility in acids is considerably lessened. The salts of protoxide of iron have a greenish color, but yield nearly colorless solutions, except when concentrated. The white hydrate is precipitated from solutions of the protosalts of iron by the pure alkalies. (*Cooley.*)

4152. Tests for Solutions of the Salts of Protoxide of Iron. When acidulated they are not precipitated by sulphuretted hydrogen; even neutral solutions with weak acids are incompletely precipitated; whilst alkaline solutions are precipitated of a black color.

Neutral solutions are precipitated black by hydrosulphuret of ammonia.

Ammonia and potassa give a greenish-white precipitate, gradually becoming green, and then brown in the air. The presence of ammoniacal salts interferes with these tests.

Ferrocyanide of potassium (yellow prussiate of potash) gives a nearly white precipitate, becoming gradually blue in the air, and immediately so on the addition of a little weak nitric acid or chlorine water.

Ferridcyanide of potassium (red prussiate of potash, produces a rich deep blue precipitate, insoluble in muriatic acid. In highly dilute solutions the effect is only a deep bluish-green coloration.

Aurochloride of sodium gives a purple precipitate; and phosphate of soda a blue one.

Cochineal freed from fat by ether, and then digested in water (or very weak spirit), gives a solution which is colored violet by the protosalts of iron.

4153. Anhydrous Sesquioxide of Iron. A pure anhydrous sesquioxide is obtained by precipitating a solution of sesquisulphate or sesquichloride of iron with ammonia in excess, and washing, drying, and igniting the resulting hydrated peroxide.

4154. Jewelers' Rouge. The best jewelers' rouge is prepared by calcining the precipitated peroxide of iron (*see No.* 4153) until it becomes scarlet. The rust of iron contains some combined water, and is more soluble than the oxide prepared by calcination; but it is less soluble than that recently precipitated from its solution in an acid. This is also called *Colcothar, Crocus,* or *Crocus Martis.*

4155. Hydrated Sesquioxide of Iron. Take 4 ounces sulphate of iron; 3½ fluid ounces oil of vitriol; water, 1 quart; mix, dissolve, and boil, then gradually add 9 fluid drachms nitric acid; stirring well and boiling for a minute or two after each addition, until the liquor yields a yellowish-brown precipitate with ammonia, when it must be filtered and precipitated with 3½ ounces strong liquor of ammonia, rapidly added and well mixed in; collect, wash well with water, drain on a calico filter, and dry at a heat not exceeding 180° Fahr. When intended as an antidote for arsenic it should not be dried, but kept in the moist or gelatinous state. It should be kept in a well-stoppered bottle filled with recently distilled or boiled water. This preparation is also called *hydrated peroxide of iron.*

4156. Peroxide of Iron. Peroxide, or sesquioxide of iron, is a brownish-red powder, known as the red oxide or rust of iron; in its hydrated form it is very soluble in acids, but less so when anhydrous. The salts of peroxide of iron have for the most part a reddish-yellow color, and redden blue litmus paper. (*Cooley.*)

4157. Tests for the Solutions of the Salts of Peroxide of Iron. Sulphuretted hydrogen throws down a black precipitate from alkaline solutions.

Hydrosulphuret of ammonia does the same with neutral solutions; in very dilute solutions the precipitate is blackish-green; the precipitate in both cases being soluble in muriatic and acetic acids.

Ammonia and potassa produce bulky reddish-brown precipitates insoluble in excess of the precipitant.

Ferrocyanide of potassium (yellow prussiate of potash) gives a rich blue precipitate, insoluble in muriatic acid, and readily decomposed by potassa.

Ferridcyanide of potassium (red prussiate of potash) deepens the color, but does not give a blue precipitate, as it does with the protoxide. (*See No.* 4152.)

Sulphocyanide of potassium gives an intense ruby-red color to neutral or acid solutions; this is the most sensitive test known.

Meconic acid and the meconiates also give a red color.

A tincture or infusion of galls strikes a black color; and phosphate of soda throws down a white precipitate.

4158. To Obtain Pure Oxalate of Iron. Vogel recommends the precipitation of a solution of an ordinary protosulphate of iron by oxalic acid. The filtered solutions exclude all insoluble matter, and the precipitated oxalate needs but sufficient washing and drying to obtain the oxalate of iron in a state of purity and of constant composition. This salt gently heated, with exposure to the air, takes fire, or may be kindled, and then continues to burn until the whole becomes converted into impalpable peroxide of iron. This cheap, rapid, and perfect method of obtaining a perfect oxide of iron, free from all grit and eminently fitted for all the finer polishing purposes, had led to the use of this article for polishing the finest optical glasses. By heating the product to a higher temperature, a much harder substance may be obtained, useful rather for grinding than for polishing purposes. By adding salts of alumina, chromium and other similar salts to the iron solution, we may obtain in the final result—using sufficient heat—products nearly, if not quite, equal to emery, and of extraordinary fineness.

4159. Acetate of Iron. Dissolve 20 ounces sulphate of iron in 7 ounces strong sulphuric acid, and heat in a porcelain dish nearly to boiling. Then add gradually 10 ounces strong nitric acid; and, when action ceases, while still hot, add sufficient ammonia to precipitate all the iron as sesquioxide. Collect this on a linen cloth, and wash with water until the washings taste no longer saline. While still moist, put the sesquioxide into a bottle with sufficient strong acetic acid to dissolve it.

Twenty ounces of sulphate of iron contain 4 ounces iron; hence, if sufficient water be added to make the acetate up to 50 ounces, the solution of acetate of iron thus obtained will contain 8 per cent. of iron.

4160. Citrate of Iron. This salt is easily formed by digesting iron filings or wire with citric acid, and evaporating the solution as quickly as possible out of contact with the air. It presents the appearance of a white powder, nearly insoluble in water, and rapidly passing to a higher state of oxidation by exposure to the air. Its taste is highly metallic. It is usually administered in the form of pills, mixed with gum or syrup, to prevent premature decomposition.

4161. Iodide of Iron. Mix together 6 ounces iodine, 2 ounces iron filings, and 4½ pints water; boil in a sand-bath until the liquid turns to a pale green, filter, wash the residue with a little water, and evaporate the mixed liquors in an iron vessel, at 212°, to dryness, and immediately put the iodide into well-stoppered bottles. A great deal has been written and said about the preparation of iodide of iron, but there is in reality very little difficulty in the process. As soon as iodine and iron are mixed together under water, much heat is evolved, and if too much water be not used, the combination is soon completed, and the liquor merely requires to be evaporated to dryness, out of contact with the air, at a heat not exceeding 212°. This is most cheaply and easily performed by employing a glass flask, with a thin broad bottom and narrow mouth, by which means the evolved steam will exclude air from the vessel. The whole of the uncombined water may be known to be evaporated when vapor ceases to condense on a piece of cold glass held over the mouth of the flask; a piece of moistened starch paper occasionally applied in the same way will indicate whether free iodine be evolved; should such be the case, the heat should be immediately lessened. When the evaporation is completed, the mouth of the flask should be stopped up by laying a piece of sheet India-rubber on it, and over that a flat weight; the flask must be then removed, and, when cold, broken to pieces, the iodide weighed, and put into dry and warm stoppered wide-mouthed glass phials, which must be immediately closed, tied over with bladder, and the stoppers dipped into melted wax.

4162. Ammonio-Citrate of Iron. Take 12¼ ounces carbonate of soda, and 12 ounces sulphate of iron; dissolve each separately in 6 pints boiling distilled water. Mix the solutions while hot, and allow the precipitate to subside. Decant the liquor, and, after washing the precipitate frequently with water, drain it. Then add to it 6 ounces citric acid in powder, and dissolve the mixture by a gentle heat. When cool, add 9 fluid ounces liquor of ammonia of specific gravity .960. It must then be filtered, gently evaporated to the consistence of syrup, and spread very thinly on warm sheets of glass to dry, which it will rapidly do, if exposed in an atmosphere of warm dry air, and may then be easily detached from the glass, in thin scales of great brilliancy and beauty. Only a gentle heat must be employed, not exceeding that of a water-bath. This is the method of producing those beautiful transparent ruby-colored scales which are so much admired. It must be kept in well-stopped bottles.

4163. Saccharine Carbonate of Iron. A sweet-tasted greenish mass or powder. It is one of the best of the chalybeates in doses of 5 to 10 grains. When pure it should be easily soluble in hydrochloric acid with brisk effervescence. Take 4 ounces sulphate of iron, and 4¼ ounces carbonate of soda; dissolve each separately in 1 quart boiling water. Mix the solutions while hot; and, after allowing time for subsidence, collect the precipitate, wash it frequently with water, and drain. Then add 2 ounces sugar previously dissolved in 2 fluid ounces water, evaporate over a water-bath to dryness, and keep in a well-stopped bottle.

4164. Carburet of Iron. *Plumbago, or black-lead,* is the native carburet of iron. To purify it for chemical use, heat it to redness with caustic potassa in a covered crucible, then wash it well with water, boil it in nitric acid and in nitro-muriatic acid (aqua regia); again wash it in water, dry it, and expose at a white heat to a stream of dry chlorine gas. Lastly, wash it with water and again heat it to dull redness. (*Dumas.*)

4165. Chloride of Iron. The *muriate* or *protochloride* of iron is obtained by dissolving iron filings or scales in hydrochloric acid, and crystallizing by evaporation. It forms soluble green crystals, and is sometimes called *hydrated chloride of iron.* The above is not quite pure, but to obtain a pure white crystalline protochloride, transmit dry hydrochloric acid gas over iron heated to redness. This is volatile at a high temperature. (*See No* 117.)

4166. Perchloride of Iron. The *permuriate* or *sesquichloride of iron* is obtained by dissolving sesquioxide or rust of iron in hydrochloric acid, evaporating to the consistence of syrup, and crystallizing. It forms red crystals, not quite pure. The pure perchloride is formed by passing chlorine over heated iron. This is soluble in water, alcohol, and ether, very deliquescent and corrosive, and is dissipated by a heat a little above 212° Fahr. (*Cooley.*) Perchloride of iron should not be given in mixtures containing medicated syrups or gum-arabic, since the latter, as well as all substances containing tannin, which is the case with those syrups, are incompatible with ferric salts. The proper menstruum is simple sugared water; it is also necessary to keep these mixtures from the light, on account of the chemical reduction produced by the latter. (*Eymael.*)

4167. Ferrocyanide of Iron. This is *pure Prussian blue.* Dissolve 9 troy ounces ferrocyanide of potassium in 2 pints water, and add it gradually, with stirring, to 1 pint of the solution of tersulphate of iron previously diluted with 1 pint water. Filter the mixture, and wash the precipitate on the filter with boiling water until the washings pass nearly tasteless. Lastly dry it and rub it into powder. (*U. S. Ph.*)

4168. Solution of Tersulphate of Iron. Take 2¼ troy ounces sulphuric acid, and 1¾ troy ounces nitric acid; mix them with ½ pint water in a large capsule, heat to the boiling point, and add 12 troy ounces sulphate of iron in coarse powder, 3 ounces at a time, stirring after each addition till effervescence ceases. Continue the heat until the solution acquires a reddish-brown color, and is free from nitrous odor. When nearly cold add water to make it up to 1½ pints. (*U. S. Ph.*)

4169. Ferridcyanide of Iron. This is better known as Turnbull's Prussian blue. (*See No.* 2674.)

4170. Tannate of Iron. Dissolve 1 part of tannin in 150 of boiling water; add 9 parts hydrated sesquioxide of iron, freshly precipitated, washed, and dried in the water-bath; evaporate gently to one half; filter, then add 1 part sugar, evaporate to dryness, and keep in a close vessel. Or: 1 part sesquioxide of iron and 2 of tannic acid evaporated to dryness with 3 parts alcohol.

4171. Nitrate of Iron. The *protonitrate of iron* is obtained by dissolving protosulphuret of iron in dilute nitric acid in the cold, and evaporating the solution in a vacuum. It forms small green crystals, very soluble, and liable to oxidation.

4172. Pernitrate of Iron. A deep red liquid formed by digesting nitric acid diluted with about half its weight of water on the sesquioxide of iron. It is also prepared from the metal. (*See No.* 116.)

4173. Oxide of Manganese. There are, according to Cooley, seven distinct compounds of oxygen and manganese, but the only one directly employed in the arts is the *black oxide (binoxide* or *deutoxide) of manganese.* It is a very plentiful mineral production, and is found in great abundance in many parts of Europe. The manganese of commerce is prepared by washing, to remove the earthy matter, and grinding in mills. The blackest samples are esteemed the best. It is chiefly used to supply oxygen gas, and in the manufacture of glass and chlorine; in dyeing, and to form the salts of manganese.

4174. Chloride of Nickel. Neutralize muriatic acid with oxide (protoxide) of nickel, and evaporate gently; small green crystals of chloride (*muriate*) of nickel. If these crystals are pure, they are rendered yellow and anhydrous by heat; if cobalt be present the salt retains a green tint.

4175. Protoxide of Nickel. The protoxide (*oxide*) of nickel is obtained in an anhydrous form by heating oxalate of nickel to redness in an open vessel. The *hydrated oxide* is an ash-grey powder formed by precipitating the oxalate of nickel with caustic potassa.

4176. Peroxide of Nickel. The peroxide (*sesquioxide*) is obtained by passing chlorine through water holding the hydrated oxide in suspension.

4177. Sulphate of Nickel. By neutralizing the protoxide of nickel with dilute sulphuric acid, green prismatic crystals of sulphate of nickel are obtained.

4178. Oxalate of Nickel. This is a pale bluish-green precipitate formed by adding a strong solution of oxalic acid to a like solution of sulphate of nickel.

4179. Tests for Solutions of the Salts of Nickel. Caustic alkalies give a pale-green precipitate, insoluble in excess of the precipitant, but soluble in a solution of carbonate of ammonia, yielding a greenish-blue liquid. Ferrocyanide of potassium gives a greenish-white precipitate. Sulphuretted hydrogen occasions no change in solutions of nickel containing free mineral acid; but with alkaline solutions gives a black precipitate.

4180. Acetate of Potassa. Mix together 26 fluid ounces acetic acid with 12 fluid ounces distilled water; add gradually 1 pound or more, until saturation, of carbonate of potassa; filter, and evaporate, by a sand-bath, to dryness.

4181. Carbonate of Potassa. This is also known under the name *Salt of Tartar*, and *Salt of Wormwood.* The crude carbonate is obtained by lixiviating (*see No.* 23) wood ashes, evaporating the solution to dryness, and fusing in iron pots for several hours. This constitutes the *potash* of commerce.

Another method of preparation is to transfer the product of the first evaporation to an oven or furnace so constructed that the flame is made to play over the alkaline mass, kept constantly stirred with an iron rod. The ignition is continued until the impurities are burned out, and the mass becomes of a bluish-white; this is commercial *pearlash.* The U. S. Pharmacopœia directs, for general purposes, the impure carbonate to be dissolved in water, filtered, and evaporated until it thickens, and then granulated in the manner directed for the pure carbonate.

4182. Pure Carbonate of Potassa. Put 12 troy ounces bicarbonate of potassa, in coarse powder, into a large iron crucible; heat gradually until the water of crystallization is driven off, then raise the heat to redness and maintain it at that heat for 30 minutes. When cool, dissolve it in distilled water, filter, and evaporate over a gentle fire until it thickens, then remove it from the fire and stir it constantly with an iron spatula until it granulates. (*U. S. Ph.*)

4183. Bicarbonate of Potassa. Dissolve 48 ounces carbonate of potassa in 10 pints distilled water; pass carbonic acid gas through the solution to saturation (the gas may be evolved from chalk by diluted oil of vitriol). Filter, and evaporate, that crystals may form, at a heat not exceeding 160° Fahr.; decant the clear, and dry the crystals. (*U. S. Ph.*)

4184. Chlorate of Potassa. Transmit chlorine gas through a moderately strong and warm solution of pure caustic potassa, or its carbonate, until the alkali be completely neutralized, then boil for a few minutes, gently evaporate until a pellicle forms on the surface, and set it aside, where it will cool very slowly. Crystals of the chlorate will form as the liquor cools, and must be collected, carefully washed with a little ice-cold water, and purified by re-solution and crystallization; the product is pure chlorate of potassa. The mother liquor, which contains much chloride potassium, by evaporation will yield more crystals, less pure than the former, or it may be saved for a future operation. This salt crystallizes in four and six-sided pearly scales; dissolves in 16 parts of water at 60°, and in 2½ parts at 212°. At about 450° it undergoes the igneous fusion, and on increasing the heat almost to redness, effervescence ensues, and fully 39 per cent. of pure oxygen gas is given off and the residue becomes changed into chloride of potassium. When mixed with inflammable substances, and triturated, heated, or subjected to a smart blow, it explodes with great violence. It also fulminates when thrown into strong acids. (*See No.* 2124.) (*Cooley.*)

4185. Perchlorate of Potassa. To concentrated sulphuric acid, gently warmed in an open vessel, add, in small portions at a time, an equal weight of well-dried and finely powered chloride of potassa. The *bisulphate of potassa* formed, is washed off with a little cold water, and the remaining perchloride of potassa dissolved in boiling water and crystallized.

4186. Chromate of Potassa. The *yellow chromate of potash* of commerce is only prepared on the large scale from the crude chrome ore, and is the common source of nearly all the other compounds of chromium. The ore, freed as much as possible from its impurities, is ground to powder in a mill, and mixed with ½ or ⅓ of its weight of bruised nitre, and in this state exposed to a powerful heat for several hours, on the hearth of a reverberatory furnace, during which time it is frequently stirred up with iron rods. The calcined matter is next raked out and lixiviated with hot water. A beautiful yellow-colored solution results, which is evaporated briskly over a naked fire, when the chromate of potash falls down under the form of a granular yellow salt, which is removed from time to time with a ladle, and thrown into a wooden vessel, furnished with a bottom full of holes, called the draining-box, where it is left to drain and dry. In this state it forms the commercial chromate of potash. By a second solution and crystallization, it may be obtained in larger and more regular crystals. (*Cooley.*)

4187. Bichromate of Potassa. The *red chromate of potash* is obtained from a concentrated solution of the yellow chromate, by adding sulphuric (or, still better, acetic) acid in quantity equal to half that required for the neutralization of the salt. (*See No.* 83.) The liquid is then concentrated by evaporation, and slowly cooled, so that crystals may form.

4188. Substitute for Bichromate of Potassa. One of the German scientific journals calls attention to the fact that for many purposes, such as for dyeing wool black, Glauber's salt and sulphuric acid can be economically substituted for bichromate of potassa. It gives the following recipe for dyeing 100 pounds of loose wool—namely, 6 pounds sulphate of soda, 2 pounds sulphuric acid, and 2 pounds sulphate of copper, which are to be boiled together for an hour, and colored with 40 to 50 pounds logwood, and 1 pound sulphate of copper, and finally colored black by means of a little sulphate of iron. The black thus obtained is pronounced to be beautiful, cheap, and easily spun, remaining loose and soft.

4189. Nitrite of Potassa. It is obtained mixed with a little nitre and potash by heating nitre to redness. To purify the residuum, dissolve it in boiling water, set aside for 24 hours, pour off the liquid from the deposited nitre, neutralize the free alkali with acetic acid, and add twice its volume of alcohol. In a few hours more, nitre crystallizes, and the liquid separates into two layers; the upper is alcoholic solution of acetate of potash, the lower is solution of nitrate of potash, which may be evaporated to dryness, or kept in solution. (*Beasley.*)

Or, pass nitrous acid gas, formed by acting on 1 part of starch with 10 of nitric acid, through a solution of caustic potash, specific gravity 1.38, until it becomes acid; then add a little caustic potash, so as to render it distinctly alkaline. It may then be kept in the liquid form, or evaporated to dryness. (*Corenwinder.*)

4190. Permanganate of Potassa. This consists of slender, prismatic crystals, of a dark-purple color, inodorous, and of a sweetish, astringent taste. It is a powerful disinfectant, and oxidizing agent, from the facility with which it parts with its oxygen. It has been found useful in medicine in various ways, and forms an excellent, though unstable hair dye. (*See No.* 1211.) It may be obtained by mixing 8 parts of peroxide of manganese with 7 parts chlorate of potassa, both in fine powder, adding 10 parts of hydrate of potassa, dissolved in a small quantity of water, evaporating to dryness, powdering, exposing the powder to a low red heat in a plantinum crucible, dissolving the mass in a large quantity of water, decanting, evaporating, and crystallizing. These crystals are permanganate of potassa. The PERMANGANATES or basic compounds of permanganic (manganesic) acid are all marked by their rapid decomposition when in contact with organic matter. (*Cooley.*)

4191. Tests for Permanganate of Potassa. A very dilute solution has a rose-color, free from green tinge, and is instantly decolorized by arsenite of potassa, with the formation of a brown precipitate. (*U. S. Ph.*) Dissolve 44 grains granulated sulphate of iron in 2 fluid drachms dilute sulphuric acid; the solution should completely decolorize 5 grains of the permanganate dissolved in water. (*Br. Ph.*)

4192. Hydrate of Potassa. This is also known under the name of *caustic potash.* Liquor of potassa, 1 gallon; evaporate in a clean iron vessel over the fire until the ebullition being finished, the hydrate of potassa liquefies; pour this into proper moulds. A pale greyish or bluish solid, very soluble in water and alcohol. It should be totally soluble in alcohol. Its solution should be scarcely affected by the nitrates of baryta and silver. It is chiefly used as a caustic, and in chemistry. (*Cooley.*)

4193. Potassa with Lime. Rub together, in a warm mortar, 1 ounce each of hydrate of potassa and quicklime, and keep the powder from the air in a well-stopped bottle. This is a caustic, but less manageable than either nitrate of silver (lunar caustic) or hydrate of potassa (caustic potash.)

4194. Nitrate of Potassa. Called also *nitre* and *saltpetre.* This salt is spontaneously generated in the soil, owing to the action of the atmosphere, and crystallizes upon its surface in various parts of the world, especially in the East Indies. It is also produced artificially by exposing a mixture of calcareous soil and animal matter to the atmosphere, when nitrate of lime is slowly formed, and is extracted by lixiviation. The liquid is then decomposed by adding carbonate of potash, by which carbonate of lime is precipitated and nitrate of potash remains in solution.

4195. To Purify Nitre. Nitre or saltpetre is purified for medicinal use in the following manner: Dissolve 4 pounds commercial nitre in 1 quart boiling distilled water; withdraw the heat, and stir constantly as it cools. The minute crystals, thus obtained, are to be drained, and washed in a glass or earthenware percolator, with cold distilled water, until the washings cease to give a precipitate with a solution of nitrate of silver. The contents of the percolator are then to be withdrawn and dried in an oven. (*Cooley.*)

4196. Tartrate of Potassa. Dissolve 8 ounces carbonate of potash in 2 quarts distilled water; whilst boiling hot, add gradually 1 pound, more or less, of bitartrate of potassa (cream of tartar) in fine powder, until the solution is neutralized, or ceases to change the color of either blue or reddened litmus paper. Filter through muslin, and evaporate until a pellicle forms on the surface; then set it aside to crystallize. After 12 hours, collect the crystals, dry them on bibulous paper, and keep preserved from the air.

4197. Bitartrate of Potassa. This is well known under the name of *cream of tartar,* and is found deposited as a crust on the sides of the casks and vats used for the fermentation of grape juice. The deposit from white wine is *white tartar;* that from red wine is *red tartar,* or *argol.* It is purified by boiling it in water, and crystallizing; it is then again dissolved in boiling water, and decolorized with charcoal (*see No.* 1729), and aluminous clay; the resulting clear liquid is allowed to cool slowly, forming crystals of the cream of tartar of commerce.

4198. Bromide of Potassium. Put 1 troy ounce iron filings into 1½ pints distilled water; add 2 troy ounces bromine, stirring frequently during 30 minutes; heat gently until the liquid assumes a greenish color, and add gradually 2⅓ troy ounces pure carbonate of potassa (previously dissolved in 1½ pints distilled water), until it ceases to produce a precipitate; continue the heat for 30 minutes, then filter. Wash the precipitate with 1 pint boiling distilled water, and filter. Mix the filtered liquids, and crystallize by evaporation. Dry the crystals on bibulous paper and keep them in a well-stoppered bottle. (*U. S. Ph.*)

4199. Chloride of Potassium. This is obtained from the mother liquor after making chlorate of potassa (*see No.* 4184), by evaporating it to dryness, and heating it to a dull redness; it is then dissolved in water, purified by defecation and crystallized by evaporation.

4200. Ferridcyanide of Potassium. This is the *red prussiate of potash,* and is obtained from a solution of 1 part ferrocyanide of potassium in 16 parts cold water, by passing chlorine gas slowly through it, with constant agitation, until the liquid appears of a reddish green color, and ceases to give a blue precipitate, or even a blue tinge, to a solution of a sesquisalt of iron, an excess of chlorine being carefully avoided. The liquor is then evaporated till a pellicle forms on the surface, filtered while hot, and set aside to cool; the crystals are again dissolved and crystallized. (*Cooley.*)

4201. Ferrocyanide of Potassium. This *yellow prussiate of potash* is the *prussiate of potash* of commerce. It is obtained by exposing 10 parts potash or pearlash; 10 parts coke, cinders, or coal; and 5 parts iron turnings, all in coarse powder, to a full red heat in an open crucible, stirring occasionally until small jets of purple flame are no longer seen. When cool, the soluble matter is dissolved out of it, the solution filtered, evaporated, and crystallized. The crystals obtained are redissolved in hot water and cooled very slowly, forming large yellow crystals of the ferrocyanide of potassium of commerce. In order to obtain a pure article, fuse effloresced commercial prussiate of potash in a glass vessel, dissolve the fused mass in water, neutralize any excess of alkali with acetic acid, and precipitate the salt with strong alcohol; wash the precipitate with a little weak alcohol, redissolve it in water, and crystallize. (*Cooley.*)

4202. Cyanide (Cyanuret) of Potassium. Mix thoroughly 8 ounces of dry ferrocyanide of potassium and 3 ounces dry carbonate of potassa; throw the mixture into a deep red-hot earthen crucible, the heat being sustained until effervescence ceases, and the fluid portion of the mass becomes colorless; after a few minutes' rest, to allow the contents to settle, the clear portion is poured from the heavy black sediment at the bottom on a clean marble slab; and, while yet warm, broken up and placed in well-closed bottles. When pure, this salt is colorless and odorless, its crystals are cubic or octahedral, and are anhydrous. If it effervesces with acids, it contains carbonate of potassa. If it be yellow, it contains iron. (*Liebig.*)

4203. Iodide of Potassium. This important medicinal compound is obtained in various ways. The United States Pharmacopœia gives the following formula for its preparation: To 6 troy ounces potassa, dissolved in 3 pints boiling distilled water, add gradually finely powdered iodine, stirring after each addition until the solution becomes colorless, and continue the addition until the liquid remains slightly colored from excess of iodine. (This will require about 16 troy ounces of iodine.) Evaporate the solution to dryness, stirring in 2 troy ounces finely powdered charcoal towards the close of the operation, so that it may be intimately mixed with the dried salt. Rub this to powder, and heat it to dull redness in an iron crucible, maintaining that temperature for 15 minutes. After it has cooled, dissolve out the saline matter with distilled water, filter the solution, evaporate, and set it aside to crystallize. An additional quantity of crystals may be obtained from the mother water by further evaporation.

A solution of iodide of potassium keeps decidedly better when there is neither plain nor aromatic syrup or sugar in it. When gargles of honey of roses, with alum and water, have a black color, though that of honey be of the proper shade, this is owing to the presence of iron in the alum, which is by no means a rare occurrence.

4204. Sulphuret of Potassium. Rub together 1 ounce sublimed sulphur, and 2 ounces dry carbonate of potassa; heat it gradually in a covered crucible until it ceases to swell and is completely melted. Pour the liquid on to a marble slab, and, when cold, break the mass into pieces, and keep in well-stopped bottle of green glass. (*U. S. Ph.*)

4205. Sulphocyanide of Potassium. Take 3 parts cyanide of potassium, and 1 part sulphur; digest them for some time in 6 parts water, then add 3 parts more water; filter, evaporate, and crystallize. It forms long, slender, colorless prisms, which are anhydrous, deliquescent, and fusible; very soluble in water and in alcohol, and not poisonous.

4206. Acetate of Soda. This is prepared from carbonate of soda, by the same method directed for acetate of potassa (*see No.* 4180), except that the resulting solution is evaporated to a pellicle, and set aside to crystallize.

4207. Sulphate of Soda. Also called *Glauber's salt.* This is usually obtained by dissolving 2 pounds of the chloride of sodium left after the distillation of muriatic acid (*see No.* 3883) in 1 quart of boiling water; the solution is next neutralized with carbonate of lime evaporated, and crystallized. It is soluble in cold water, its solubility decreasing as the temperature of the water is raised; insoluble in alcohol, and fuses when heated.

4208. Carbonate of Soda. The carbonate of soda of commerce is either prepared by lixiviating the ashes of sea-weed, or from sulphate of soda. The ashes of marine plants have been long an article of commerce, under the names of *barilla, barilla ashes, kelp, blanquette, &c.*, but the carbonate made from them is of a very impure description. That made from the sulphate is much purer, and, when the process is well managed, merely contains a trace of sulphuric acid. The sulphate of soda is mixed with an equal weight of chalk and about half its weight of coal, each being previously ground to powder, and the mixture is exposed to a great heat in a reverberatory furnace, and during the calcination is frequently stirred with a long iron rod. The dark grey product usually contains about 22 or 23 per cent. of carbonate of soda. This is now lixiviated with tepid water, and the solution, after defecation, evaporated to dryness, mixed with a little sawdust, and roasted in a reverberatory furnace at a heat not exceeding 700° Fahr., until all the sulphur is expelled. The product now receives the name of soda-ash, or soda-salt, and contains about 50% of alkali. It may be purified by solution in water, defecation, evaporation, and crystallization; it then becomes commercial crystallized carbonate of soda, consisting of large transparent crystals, which effloresce by exposure to the air, crumbling into a white dry powder. The carbonate used in medicine is prepared from the commercial crystals by dissolving, filtering, and careful crystallization.

4209. Bicarbonate of Soda. This may be prepared from a solution of carbonate of soda treated in the same manner as for bicarbonate of potassa. (*See No.* 4183.) The U. S. Pharmacopœia directs carbonate of soda in small pieces to be enclosed in a box (having an air-tight lid, and an inner bottom perforated with holes), and thus subjected, until saturated, to a stream of carbonic acid gas previously passed through water.

Cooley recommends the following process: Mix together 1 part carbonate of soda with 2 parts dried carbonate of soda, both in powder, and surround them with an atmosphere of carbonic acid gas, under pressure. Let the action go on till no more gas is absorbed, which will generally occupy 10 to 14 hours, according to the pressure employed, then remove the salt and dry it at a heat not above 120° Fahr.

4210. Phosphate of Soda. Mix 10 pounds powdered bone ashes with 44 fluid ounces sulphuric acid; add gradually 6 pints water, and digest for 3 days, replacing the water which evaporates; then add 6 pints boiling water, strain through linen, and wash the residue on the filter with boiling water. Mix the liquors, and, after defecation, decant and evaporate to 6 pints; let the impurities again settle, and neutralize the clear fluid, heated to boiling, with a solution of carbonate of soda in slight excess; crystals will be deposited as the solution cools, and by successively evaporating, adding a little soda to the mother liquor till it is feebly alkaline, and cooling, more crystals may be obtained. Keep it in closed vessels. (*Ed. Ph.*)

4211. Hyposulphite of Soda. Mix together 1 pound dried carbonate of soda and 10 ounces flowers of sulphur, and slowly heat the powder in a porcelain dish until the sulphur melts; stir freely, to expose it to the atmosphere, until the incandescence flags, then dissolve the mass in water, and immediately boil the filtered liquid with some flowers of sulphur; lastly, carefully concentrate the solution for crystallization. (*Cooley.*)

It may also be prepard by dissolving 8 parts carbonate of soda in 16 parts water; add 1 part sublimed sulphur, and pass sulphurous acid gas, in excess, into the solution; boil the liquid in a glass matrass for a few minutes, filter, gently evaporate the filtrate to ⅓ its volume, and set it aside in a cool place to crystallize. (*Paris Codex.*)

4212. Tungstate of Soda. This is formed by dissolving tungstic acid in a concentrated solution of pure soda. *Tungstic acid* is a yellow powder obtained by digesting native tungstate of lime, finely powdered, in nitric acid. It forms TUNGSTATES with metals and bases.

4213. Potassio-Tartrate of Soda. Known in commerce as *Seignette's* or *Rochelle* salt. Dissolve 12 ounces carbonate of soda in 2 quarts boiling water; add gradually 16 ounces bitartrate of potassa in fine powder. Strain, evaporate to a pellicle or crust (*see No.* 9), and set it aside to crystallize. The mother liquor may be further evaporated for a second supply of crystals. (*Cooley.*) The U. S. Pharmacopœia adopts the same method, but directs 5 pints of boiling water to be used.

4214. Bromide of Sodium. This is now employed to a great extent instead of bromide of potassium; it is more active than the latter, is more quickly absorbed, and more regularly eliminated. To prepare it pure and in large quantities the following method is recommended: Bromide of ammonium is decomposed by an equivalent quantity of caustic or carbonate of soda, which, of course, must be free from sulphuric and hydrochloric acids. The solution yields, after evaporation, small cubes of anhydrous bromide of sodium.

4215. Chloride of Sodium. This is a muriate of soda, or common table salt, and is largely obtained by the evaporation of sea water, or from the water of salt springs. It dissolves in about 2½ parts of water at 60° Fahr.; is insoluble in pure alcohol; fuses at a red heat; and at a higher temperature becomes volatile.

4216. Iodide of Sodium. This is obtained from soda in the same manner as iodide of potassium. (*See No.* 4203.)

4217. Nitro-Prusside of Sodium. To 213 parts of powdered ferroprussiate of potash, in a porcelain basin, add 450 parts of nitric acid of 1.42 density (or 337½ parts at 1.50), adding all the acid at once. When dissolved, transfer to a bolt-head, and digest in a water-bath until the solution precipitates salts of protoxide of iron of a slate color. Neutralize, when cold, with a cold solution of carbonate of soda; then boil, and separate the precipitate by filtration. Evaporate the liquid again, filter, and allow the nitrates of potash and soda to crystallize out. Evaporate the liquid again, and remove the prismatic crystals of nitro-prusside as they form. They may be dissolved in water and recrystallized by cooling.

4218. Acetate of Ammonia. Mix together equal parts of sal-ammoniac and acetate of potassa, and distill; binacetate of ammonia passes over into the receiver, as an oily liquid, which, on cooling, forms a radiated crystalline mass. By passing dry ammoniacal gas into this salt, melted by a gentle heat, it is transformed into the neutral acetate, and becomes solid and inodorous.

Or: By saturating strong acetic acid with ammonia, and evaporating over sulphuric acid in vacuo, crystals of acetate of ammonia may be obtained. Very soluble both in alcohol and water, and very deliquescent.

4219. Carbonate of Ammonia. The *Neutral Carbonate* is prepared by mixing equal parts sal-ammoniac, powdered and well dried, and dried carbonate of soda, and subliming, by a gradually increased heat, from an earthen retort into a refrigerated receiver.

4220. Sesquicarbonate of Ammonia. This is the *commercial carbonate of ammonia*, and is prepared as follows; Sal-ammoniac, or pure commercial sulphate of ammonia, and chalk, equal parts, both dry and in powder. Mix and sublime from an iron pot, into a long earthen or leaden receiver, well cooled. The receiver is usually fitted with a moveable lead cover, secured by a water-joint, and has an open lead pipe in the bottom, to allow the liquid products of the distillation to drain off into a second receiver. When made of the impure sulphate of ammonia, it must be re-sublimed in iron pots, furnished with leaden heads kept cool. A little water is commonly introduced into the subliming pots, to render the product translucent. The heat is usually applied by means of a common furnace, but a steam or water bath is preferable, as the temperature required for this purpose does not exceed 200° Fahr.

4221. Bicarbonate of Ammonia. The commercial carbonate reduced to fine powder, and exposed to the air for 24 hours, becomes a bicarbonate spontaneously. It can also be obtained by passing a stream of carbonic acid gas through a solution of the sesquicarbonate until saturated, and drying the crystals which form without heat.

4222. Muriate of Ammonia. Also called *sal-ammoniac* and *hydrochlorate of ammonia.* This substance was formerly prepared in Egypt by the sublimation of the soot from camels' dung, which yields from ⅙ to ¼ its weight. The sal-ammoniac of commerce is now wholly prepared at the great chemical works, and never by the small consumer, by whom it is merely occasionally refined or purified. The crude ammoniacal salt of the gas-works is placed in iron pots, lined with clay, and a leaden dome or head adapted, and heat applied until the whole has sublimed. When the crude salt is a sulphate, it is mixed with a sufficient quantity of muriate of soda before sublimation, and the sal-ammoniac is formed by the double decomposition of the ingredients. The preparation of sal-ammoniac from bone-spirit salt is nearly similar. The sal-ammoniac of commerce is found under the form of large hemispherical, cup-like cakes or masses, having a semi-crystalline texture, and varying in weight from 100 to 1000 pounds. It forms a clear and colorless solution with water, and wholly volatilizes by heat. Mixed with lime or caustic potassa, it evolves the pungent odor of ammonia; it gives a white curdy precipitate with nitrate of silver. The sal-ammoniac of commerce is generally sufficiently pure for all the purposes of the arts, but when wanted of greater purity, it may be broken into pieces and re-sublimed from an earthenware vessel into a large receiver of earthenware or glass, in which state it is known as "flowers of sal-ammoniac," from being in fine powder. Chemically pure hydrochlorate of ammonia may be prepared by adding the pure carbonate of ammonia to dilute hydrochloric acid until saturated. (*Cooley.*)

4223. Sulphate of Ammonia. The commercial sulphate is obtained by saturating with weak oil of vitriol the ammoniacal liquor of the gas-works, or bone-spirit. For medicinal purposes it is prepared by saturating dilute sulphuric acid with sesquicarbonate of ammonia in slight excess; it is then filtered, evaporated by a gentle heat, and crystallized.

4224. Murexide. This is the *purpurate of ammonia,* and consists of iridescent crystals, which reflect a beautiful green color, but transmit an equally fine reddish-purple color. It is obtained from *alloxan,* a substance formed by the action of nitric acid on uric acid.

4225. Iodide of Ammonium. Place a portion of iodine in a flask with a little water; add to it a solution of hydrosulphuret of ammonia, until the mixture loses its red color, and is turbid from the separation of sulphur; by shaking the flask, the most of the sulphur will form into a mass. Pour off the liquid, and boil it until all odor of sulphuretted hydrogen and of ammonia is lost. Then filter it, and evaporate it, constantly stirring, over a flame, until it becomes pasty, and then in a water-bath until it forms a dry salt. (*U. S. Dis.*)

4226. Sulphocyanide of Ammonium. Saturate 2 parts of common water of ammonia (specific gravity 0.950) with sulphuretted hydrogen; and add 6 parts of the same ammonia. To this mixture add 2 parts of sulphur, and the product of the distillation of 6 parts of prussiate of potash, 3 of sulphuric acid, and 18 of water. Digest till the sulphur is no longer acted on, and the liquid becomes yellow. Boil the liquid till it becomes colorless, filter, evaporate, and crystallize.

4227. Bromide of Ammonium. For the preparation of bromide of ammonium, bromine is added very gradually to diluted ammonia. The ensuing reaction produces much heat, which may cause ammonia and bromine to volatilize with the escaping nitrogen. The combination, therefore, is effected in a Wolffe's apparatus, which will condense and retain both perfectly. The evaporation of the fluid is also best done in an iron retort connected with a stoneware receiver, in which ammonia and some bromide of ammonium are condensed.

4228. Sulphuret of Ammonium. Usually called *hydrosulphuret of ammonia.* This is prepared from strong liquor of ammonia, by saturating it with sulphuretted hydrogen gas, and then adding a second portion of liquor of ammonia, equal in strength and quantity to that first used. Keep it in well-stoppered bottles. (*See No.* 1203.)

4229. Manganate of Baryta. The manganate of baryta, and of other alkalies, is formed by igniting the nitrate of the alkalies with peroxide of manganese, with excess of air, and dissolving in water. (*Booth.*)

4230. Nitrate of Baryta. It is prepared in the same manner as muriate of baryta (*see No.* 4234), substituting pure nitric acid for the muriatic acid.

4231. Sulphate of Baryta. This occurs as a native mineral, and is white, if pure. It occasionally contains iron, which may be removed by washing first with dilute sulphuric acid, and afterwards with pure water. (*See No.* 2697.)

4232. Acetate of Baryta. Dilute acetic acid neutralized with carbonate of baryta, and evaporated to form crystals.

4233. Carbonate of Baryta. A heavy white powder found in the crude state abundantly in nature, and sufficiently pure for general purposes. The pure carbonate may be precipitated from a solution of chloride of barium by the addition of any pure alkaline carbonate, washing and drying the product. (*Cooley.*)

4234. Chloride of Barium. Also called *Muriate of Baryta.* Mix gradually 10 ounces carbonate of baryta in small pieces, with ½ pint muriatic acid diluted with 1 quart distilled water; evaporate to a pellicle or crust (*see No.* 9), and set aside to crystallize.

4235. Protoxide of Barium. This is the oxide of barium or baryta. (*See No.* 3985.)

4236. Peroxide of Barium. The peroxide or *binoxide* is prepared from pure baryta, heated to a full red heat in a porcelain tube, and exposed to a stream of pure dry oxygen gas. Instead of baryta, its nitrate may be used, but the nitrous fumes must be allowed to pass off entirely before applying the oxygen.

4237. Sulphuret of Barium. Calcine and reduce to powder 2 pounds sulphate of baryta, mix it with 4 ounces finely powdered charcoal; submit the mixture for 3 hours to a low white heat in a covered crucible. When cool, powder, and boil for 5 minutes in 5 pints water; decant the clear, and repeat the operation with 3 pints more water; unite the liquors, and crystallize by cooling.

4238. Carbonate of Lithia. Precipitate a solution of sulphate of lithia, by a strong solution of sesquicarbonate of ammonia; collect the precipitate, drain and press it, wash it with a little rectified spirit, and dry it. Dissolve in boiling water, and crystallize by slow evaporation.

4239. Sulphate of Lithia. Finely powdered petalite, 1 part; fluorspar, 2 parts; mix, add oil of vitriol, 10 parts, and heat the mixture as long as acid vapors are evolved. The residuum must be dissolved in pure water of ammonia, boiled, filtered, the solution evaporated to dryness, and the dry mass heated to redness. The matter left is pure sulphate of lithia. (*Berzelius.*)

Petalite or *Spondumene* is a mineral found in various parts of Europe, also in Massachusetts and Connecticut. (*Booth.*)

4240. Carbonate of Magnesia. There are two simple carbonates of magnesia, the heavy and the light.

The *heavy carbonate* is prepared from a saturated solution of sulphate of magnesia, 1 part by measure; water, 3 parts; heat to the boiling point, then add cold saturated solution of carbonate of soda, 1 part; boil, with constant agitation, till effervescence ceases, then add boiling water, 100 parts, agitate well, decant off the clear liquid, drain, and wash the precipitate with hot water, in a linen cloth, and finish the drying by heating it in an iron pot.

The *light carbonate* is obtained from 4 pounds sulphate of magnesia, and 4 pounds 9 ounces carbonate of soda, each separately dissolved in 2 gallons water. Mix and boil the liquors, constantly stirring for 15 minutes; after subsidence, decant the clear, wash the precipitate with boiling water, and dry it. The carbonate of magnesia of commerce is usually made up into cakes or dice, while drying, or is permitted to drain and dry in masses, which are then cut into shapes with a thin knife. It is powdered by rubbing it through a wire sieve. (*Cooley.*)

4241. Sulphate of Magnesia. This is the well-known *Epsom salts* of commerce, called after the saline springs of Epsom, in England, from the waters of which it was originally obtained. It is prepared on the large scale from *Dolomite,* or magnesian limestone. Heat the mineral with sufficient dilute sulphuric acid to convert all its carbonate into sulphate of lime, wash out all the sulphate of magnesia with hot water, and, after defecation, evaporate and crystallize.

Or, from bittern. Boil the residual liquor, or mother-water of sea-salt, for some hours, skim, and decant the clear, then concentrate by evaporation, and run the solution into wooden coolers; in 1 or 2 days ⅛ part of Epsom salts will have crystallized out. This is called *singles.* By re-solution in water, and re-crystallization, *doubles,* or Epsom salts, fit for the market, are obtained.

4242. Sulphuret of Magnesia. The *sulphide,* or sulphuret, is prepared by fusing together, in a covered crucible, 5 parts calcined magnesia and 4 parts sulphur.

4243. Chloride of Magnesium. Dissolve magnesia in muriatic acid, evaporate to dryness, add an equal weight of muriate of ammonia, project the mixture into a red hot platinum crucible, and continue the heat until tranquil fusion is attained. Pour out the fused mass on to a clean stone; and, when solid, break it into pieces, and transfer to a warm, dry bottle. (*Cooley.*)

Or: Dissolve magnesia in muriatic acid; evaporate to a specific gravity of 1.384; and put it, while hot, into a wide-mouthed flask to crystallize. (*Paris Codex.*) This chloride of magnesium is also called *hydrochlorate* or *muriate* of *magnesia.*

4244. Acetate of Lime. Neutralize acetic acid with prepared chalk (*see No.* 1292), filter the solution, evaporate by a gentle heat, and allow to crystallize.

4245. Chloride of Lime—called also *hypochlorite* and *oxymuriate of lime, bleaching powder,* and *chlorinated lime*—is seldom, if ever, made on the small scale, as it can be purchased of the large manufacturer of better quality and cheaper than it could possibly be made by the druggist. On the large scale the chlorine is generated in leaden vessels, heated by steam, and the gas, after passing through water, is conveyed by a leaden tube into an apartment built of silicious sandstone, and arranged with shelves or trays, containing fresh-slacked lime, placed one above another about an inch asunder. The process must be continued for 4 days to produce a good article of chloride of lime. During this time the lime is occasionally agitated by means of iron rakes, the handles of which pass through boxes of lime placed in the walls of the chamber, which act as valves.

4246. Chloride of Calcium. Known also as *muriate of lime.* From the strong affinity this salt has for water, it is much used for drying gases and absorbing the water from ethereal and oily liquids, in organic analyses. For this purpose it is used in the dry state. In its hydrous or crystallized form, it is much used in the preparation of freezing mixtures with snow. In this case, the evaporation need only be conducted so far that the whole becomes a solid mass on removal from the fire. For both this and the last-mentioned use it is reduced to powder. It is also much used as a test for sulphuric acid, with which it produces a white precipitate insoluble in nitric acid; in the rectification of alcohol, and for forming a water-bath with a high boiling point. As a medicine, it has been given in some scrofulous and glandular diseases, and has also been used as a bath in the same cases.

4247. To Prepare Chloride of Calcium. To hydrochloric acid, diluted with an equal weight of water, add powdered chalk or white marble, in small fragments, until effervescence entirely ceases, and the liquid no longer reddens litmus paper. Filter, evaporate to one-half, and set it aside to crystallize. Then collect the crystals, dry them by pressure between bibulous paper, and keep in a stoppered bottle. The mother-liquid will yield more crystals by further evaporation.

4248. Hyposulphite of Lime. Slack 5 ounces lime with enough water to make 4 pints, boil up with 10 ounces of flowers of sulphur, and pass into the solution sulphurous acid gas (free from carbonic acid) until it has become colorless. Then filter and evaporate to crystallization, at a temperature not exceeding 140° Fahrenheit. Another way to prepare this salt is to mix 44 ounces (by weight) of a solution of fused chloride of calcium of 1.238 specific gravity, with a warm solution of 25 ounces hyposulphite of soda in 30 ounces water; evaporate to 38 ounces, and pour off, while warm, from the crystals of chloride of sodium; then allow to crystallize, and purify the crystals by re-solution.

4249. Cobalt. A metal found in ores associated with arsenic and other metals; also present in meteoric iron. It is white, brittle, and does not change in the air; has a high melting point, and is strongly magnetic. Specific gravity 8.5. (*Cooley.*)

4250. Nitrate of Cobalt. This may be obtained by dissolving metallic cobalt in nitric acid, and collecting the crystals. These crystals are ready soluble in water; of a red color; deliquescent, and melt below 212° Fahr. At a higher heat, nitrous fumes are given off, and *peroxide of cobalt* remains.

4251. Chloride of Cobalt. Dissolve carbonate of cobalt in muriatic acid; the solution deposits rose-colored crystals on standing, which contain water. By evaporating the solution, anhydrous blue crystals of the chloride are obtained. (*Cooley.*)

4252. Carbonate of Cobalt. This is precipitated from a solution of nitrate of cobalt, by carbonate of potassa, producing a pale peach-colored powder, soluble in acids. (*Cooley.*)

4253. Acetate of Cobalt. The acetate is obtained by dissolving carbonate of cobalt in acetic acid. Acetate of cobalt forms a sympathetic ink. (*See No.* 2540.)

4254. Manganese. A hard, brittle, greyish-white metal, very easily oxidized, fuses with difficulty, unaffected by cold water, but dissolving freely in dilute sulphuric acid, evolving hydrogen gas. It has a specific gravity of 8.013. It is obtained by calcination in a crucible, at a strong heat, of 10 parts by weight of an oxide of manganese, made into a paste with oil, and combined with 1 part calcined borax.

4255. Peroxide of Manganese. The *black oxide* is the only oxide of manganese that is directly employed in the arts. It is a plentiful mineral production in a crude state; and is purified by grinding the native mineral or *pyrolusite* in mills, and removing the earthy matter by washing. The blackest samples are esteemed the best.

4256. Alum. The alum of commerce is a sulphate of alumina and potassa, obtained by lixiviation (*see No.* 23) from crude alum ore, or *schist.* It is obtained in large crystals, slightly efflorescent. It is applied in the arts to a great variety of purposes. When deprived of its water of crystallization by heat, it becomes *burnt* or *dried alum.* Pure *red* or *roche alum* was originally imported from Italy, where it is found in a native state. This has a reddish tinge, which extends more or less through the crystals.

4257. Hydrate of Alumina. Dissolve alum in 6 times its weight of boiling water, add a solution of carbonate of potassa, in slight excess, agitate the mixture for a few minutes, and then allow it to repose. After a time, pour the clear supernatant liquor from the precipitate or sediment, and wash the latter three or four times with tepid distilled or soft water. Next collect the precipitate on a fine calico filter, and again wash it with tepid water. When it has drained, press it between bibulous paper, and, lastly, dry it either without heat, or at a temperature not higher than 120° to 130° Fahr. The product is a soft white powder. (*Cooley.*)

4258. Acetate of Alumina. Add a solution of acetate of baryta to another of sulphate of alumina, and filter. Or, add 5 parts alum to 6 parts sugar of lead, each being first dissolved separately in hot water, and allowed to cool before mixing; decant the clear liquor. The pure acetate is made from pure hydrate of alumina, by digesting it in cold, strong acetic acid, until the latter is saturated. By spontaneous evaporation long transparent crystals form.

4259. Sulphate of Alumina. Saturate dilute sulphuric acid with hydrate of alumina; evaporate and crystallize.

4260. Butyrine. An oily fluid obtained from butter. Keep clarified butter in a porcelain vessel, at a heat of 66°, for some days; carefully collect the oily portion which separates, and agitate it with an equal weight of absolute alcohol for 24 hours, then pour off the clear and evaporate, treat the oily residuum with a little carbonate of magnesia to remove any free acid, and wash off the *butyrate* of *magnesia* thus formed with water; next heat the remaining fatty matter in alcohol, filter, and evaporate, to obtain the butyrine.

4261. Bromine. A dark reddish-colored liquid, having an odor resembling chlorine. It freezes at —4°, boils at about 135° Fahr., is very soluble in ether, less so in alcohol, and only slightly so in water. With hydrogen it forms *hydrobromic acid,* and, with the bases, compounds called BROMIDES or HYDROBROMATES. It is obtained as follows: A current of chlorine is passed through the uncrystallizable residuum of sea-water, called *bittern,* which then assumes an orange tint, in consequence of bromine being set free from its combinations; sulphuric ether is then agitated with it, and the mixture allowed to stand until the ethereal portion, holding the bromine in solution, floats upon the surface. By decanting, and evaporating the ether, a crude bromine may be obtained at once. To get it pure, the ethereal solution is carefully decanted, and agitated with a solution of potassa, by which means bromide of potassium and bromate of potash are formed. The whole is next evaporated to dryness, and submitted to a dull red heat; the residuum is then powdered, mixed with pure peroxide of manganese, and placed in a retort; sulphuric acid, diluted with half its weight of water, is now poured in. Red vapors immediately arise, and condense into drops of bromine, and are collected by plunging the neck of the retort to the bottom of a small receiver containing cold water. The bromine forms a stratum beneath the water, and may be collected and further purified by distillation from dry chloride of calcium. (*Cooley.*)

4262. Iodide of Cadmuim. This is prepared by mixing iodine and cadmuim filings in a moist state. This is freely soluble in water or alcohol, and may be crystallized by evaporation from ether solution, in large white transparent crystals. (*U. S. Disp.*)

4263. Bromide of Cadmium. This is made from cadmium filings and bromine, in the same manner as the iodide of cadmium from iodine. It consists of long, white, efflorescent, crystalline needles.

4264. Hydriodate of Quinine. To a concentrated solution of neutral sulphate of quinine, add, drop by drop, a concentrated solution of iodide of potassium; dry the precipitate in the shade; or, heat the liquid nearly to the boiling point, and allow it to crystallize.

4265. Sulphate of Quinine. This is the disulphate of quinia. Boil 48 troy ounces coarsely powdered yellow cinchona, in 13 pints of water containing $1\frac{1}{6}$ troy ounces muriatic acid, and strain through muslin. Boil the residue twice successively with the same quantity of water and acid as before, and strain. Mix the decoctions, and, while the liquid is hot, gradually add 5 troy ounces finely powdered lime, previously mixed with

2 pints of water, stirring constantly until the quinia is completely precipitated. Wash the precipitate with distilled water; and, having pressed, dried, and powdered it, digest it in boiling alcohol. Pour off the liquid, and repeat the digestion several times until the alcohol is no longer rendered bitter. Mix the liquids, and distill off the alcohol until a brown viscid mass remains. Transfer it to a suitable vessel, and pour upon it 4 pints distilled water; and, having heated the mixture to the boiling point, add as much sulphuric acid as may be necessary to dissolve the quinia. Then add 1½ troy ounces animal charcoal, boil for 2 minutes, filter while hot, and set it aside to crystallize. Should the liquid before filtration be entirely neutral, acidulate it very slightly with sulphuric acid; should it, on the contrary, change the color of litmus paper to a bright red, add more charcoal. Separate the crystals from the liquid, dissolve them in boiling distilled water slightly acidulated with sulphuric acid, add a little animal charcoal, filter the solution, and set it aside to crystallize. Lastly dry the crystals on bibulous paper with a gentle heat, and keep them in a well-stopped bottle. The mother-water may be made to yield an additional quantity of sulphate of quinia by precipitating the quinia with water of ammonia, and treating the precipitate with distilled water, sulphuric acid, and animal charcoal, as before. (*U. S. Ph.*) When pure it forms light, delicate, white needles. It is entirely soluble in hot water, and more readily so when an acid is present. Precipitated by ammonia, the residuary liquid, after evaporation, should not taste of sugar. By a gentle heat it loses 8 or 10 per cent. of water. It is wholly consumed by heat. If chlorine be first added, and then ammonia, it becomes green. A solution of 10 grains in 1 fluid ounce distilled water, and 2 or 3 drops of sulphuric acid, if decomposed by a solution of ½ ounce carbonate of soda, in two waters, and heated till the precipitate shrinks and fuses, yields on cooling a solid mass, which, when dry, weighs 7.4 grains, and in powder dissolves entirely in a solution of oxalic acid.

4266. Tests for the Purity of Sulphate of Quinine. This salt is frequently adulterated with starch, magnesia, gum, sugar, &c. The first three remain undissolved when the salt is digested in spirit; the fourth is dissolved out by cold water, and the last may be detected by precipitating the quinine by liquor of potassa, and dissolving the precipitate in boiling alcohol; cinchona crystallizes out as the solution cools, but the quinine remains in the mother liquor. (*Cooley.*)

Dr. Stonelen proposes a test for the presence of salicine in sulphate of quinine. He employs three kinds of sulphuric acid—viz.: the fuming, pure concentrated acid, free from arsenic and nitric acid; ordinary concentrated sulphuric acid of commerce, containing a trace of nitric acid; and, lastly, sulphuric acid, to which, purposely, nitric acid had been added. Watch glasses having been placed on a sheet of white paper, and a drop or two of the acids above referred to (each in a separate glass) having been poured therein, a few crystals of sulphate of quinine are put on the acid; if pure, there is no coloration; but, even with 1 per cent. of salicine, the two first-named acids cause a distinct red coloration, which does not ensue with the acid containing nitric acid. This latter acid is not even colored by pure salicine.

4267. Acetate of Morphia. The acetate of morphia of commerce is usually in the form of a whitish powder, and is prepared by the mere evaporation of the solution to dryness by a gentle heat. During the process a portion of the acetic acid is dissipated, and hence this preparation is seldom perfectly soluble in water, unless it be slightly acidulated with acetic acid. It is prepared by dissolving 6 drachms morphia in 3 fluid drachms acetic acid specific gravity 1.048, diluted with 4 fluid ounces distilled water; evaporate gently, and crystallize. 100 measures of a solution of 10 grains in ½ fluid ounce water, and 5 minims of acetic acid, heated to 212°, and decomposed by a very slight excess of ammonia, yield by agitation a precipitate, which, in 24 hours, occupies 15½ measures of the liquid.

4268. Opium. The juice obtained by cutting the unripe fruit of the white poppy, and hardened by exposure to the air. It yields several alkaloids, the principal of which is morphine. The best opium comes from Smyrna, in Turkey. Sometimes the commercial article is found adulterated with various substances in order to increase its weight.

4269. To Test the Strength of Opium. Take 25 grains quicklime made into a milk with water, boil in this 100 grains opium, and filter the solution while hot; saturate the filtrate with dilute hydrochloric acid, and then precipitate the morphia by the addition of liquor of ammonia, any excess of the latter being expelled by heat. Collect the precipitate, dry, and weigh it; the weight in grains will represent the percentage of morphia in the sample of opium tested. (*Couerle.*)

4270. To Test the Purity of Opium. Macerate 100 grains opium for 24 hours in 2 fluid ounces water; filter and express the residue; then precipitate with a solution of ½ ounce carbonate of soda in 2 fluid ounces cold water; gently heat the precipitate until it fuses, then cool and weigh it. It should weigh at least 10 grains; and, when powdered, be entirely soluble in a solution of oxalic acid.

4271. Chloroform. A thin, colorless liquid, of agreeable ethereal odor, and sweetish but slightly acrid taste. Its specific gravity (water standard) is 1.49, and the specific gravity of its vapor (air standard) is 4.2. It kindles with difficulty, burning with a greenish flame, and gives a dull, smoky-yellow color to the flame of alcohol. It occupies a prominent place among the *anæsthetics* (substances used to produce insensibility to pain by inhaling them), but has in later times been, to a certain extent, superseded by nitrous oxide. (*See No.* 4060.) Externally applied, it is refrigerant, soothing, and allays pain. It neither reddens nor bleaches litmus paper.

4272. To Obtain Chloroform. This is prepared on the large scale, by mixing, in a capacious retort or still, 4 pounds chloride of lime, 12 pounds water, and 12 fluid ounces rectified alcohol; distill cautiously as long as a dense liquid is produced, which sinks in and separates from the water with which it passes over. Separate the lower stratum of chloroform from the water, agitate it with a little sulphuric acid, and distill it by the heat of a water-bath from carbonate of baryta. (*Dumas.*)

4273. To Obtain Pure Chloroform. Place in a capacious still 3 gallons water and 30 fluid ounces rectified spirit, and raise the temperature to 100° Fahr. Add 10 pounds *chlorinated lime* (slacked lime saturated with chlorine gas), and 5 pounds slacked lime, mixing thoroughly. Apply heat, which must be withdrawn as soon as distillation has commenced, and distill 50 ounces; agitate it with ½ gallon water, and allow the crude chloroform to settle. Separate and wash the chloroform with 3 fluid ounces distilled water, repeating this operation 3 times, each time with fresh distilled water. Next agitate the chloroform for 5 minutes with an equal volume of sulphuric acid; when settled, transfer the upper stratum to a flask containing 2 ounces chloride of calcium in small pieces, and ½ ounce perfectly dry slacked lime. Agitate thoroughly, and, after an hour, distill the pure chloroform over a water-bath. Keep in a well-stoppered bottle, in a cool place. The U. S. Dispensatory has transferred this from the British Pharmacopœia, consequently avoirdupois weight and Imperial measure are adopted.

4274. To Purify Commercial Chloroform. To 102 troy ounces commercial chloroform, add 17 troy ounces sulphuric acid, occasionally shaking during 24 hours. Separate the lighter liquid and mix it with 6 fluid drachms stronger alcohol. Then add 2 troy ounces carbonate of potassa, previously heated to redness, and rubbed into powder while warm. Agitate thoroughly and distill to dryness. Keep the distilled liquid in well-stopped bottles. (*U. S. Ph.*)

4275. Tests for the Purity of Chloroform. Its specific gravity should not be less than 1.490, nor more than 1.494; and should boil at 140° Fahr. When dropped into water, it sinks in transparent globules without milkiness. When mixed in a bottle with an equal bulk of sulphuric acid, it should produce no warmth; and after standing for 24 hours, neither liquid should be discolored, or, at most, a faint yellow tinge imparted to the lower or acid stratum; more discoloration than this would denote the presence of empyreumatic oily matter. When evaporated on a porcelain plate, it leaves behind a slightly aromatic odor, but free from pungency.

4276. Chloral. Chloral is an oily liquid, possessing an ethereal smell; it is soluble in alcohol, ether, and water, but its solution in the latter rapidly changes into a semi-solid crystalline mass of *hydrate* of *chloral*, soluble in a larger quantity of water. Chloral boils at 202°, and has a specific gravity of 1.502.

4277. To Obtain Chloral. Place anhydrous alcohol in a tubulated retort, and pass dry chlorine gas through it, at first in the cold, but afterwards with the application of a gentle heat. As soon as the chlorine passes undecomposed through the liquor at the boiling temperature, the process is complete. On cooling, the liquid in the retort solidifies, forming a crystalline mass of hydrated chloral. This must be melted by gentle heat, and agitated with thrice its volume of oil of vitriol, when, on increasing the heat a little, an oily stratum of impure chloral will rise to the surface. This must be removed, boiled for some time, to drive off some free hydrochloric acid and alcohol, and next distilled with an equal volume of oil of vitriol; lastly, it must be rectified from finely-powdered quicklime, stopping the process as soon as the surface of the lime becomes dry. The chlorine is best introduced by a tube inserted into the tubulature of the retort, and a long tube, bent upwards, should be connected with the beak to convey away the hydrochloric acid gas extricated, and to allow the volatilized alcohol and chloral to condense and flow back into the retort.

4278. To Purify Hydrate of Chloral. There is perhaps scarcely a liquid in which chloral hydrate is insoluble at ordinary temperature; four parts of it dissolve gradually in one part of water, the solution crystallizes at 32° Fahr., but not in well-formed crystals. Alcohol and ether dissolve it to such an extent that it likewise does not crystallize well on evaporating these solvents; absolute alcohol must be excluded, because it combines with chloral. Chloroform and benzole are well adapted for recrystallization, but the first is too dear, and the last cannot be entirely removed from the crystals. The same holds good for most other liquid solvents, but uniformly satisfactory results are obtained with bisulphide of carbon; 45 parts of it dissolve at 60° to 65° Fahr., but 1 part chloral hydrate; it precipitates ethereal and alcoholic solutions of the latter. But at temperatures below the boiling of bisulphide of carbon, 4 to 5 parts of it are sufficient for dissolving 1 part chloral hydrate. If allowed to cool slowly, beautiful crystals, often an inch in length, are obtained, easily collected, and readily freed from the last traces of the solvent by exposing them in thin layers to the air. (*Flückiger.*)

4279. Sulphuric Ether—also called *oxide of ethyl*—is a colorless, transparent, very limpid fluid, having a penetrating and agreeable smell and a burning taste.

4280. To Obtain Sulphuric Ether. Put 2 pounds rectified spirit into a glass retort, and add 2 pounds sulphuric acid; place the retort on a sand-bath, and apply heat so that the liquor may boil as quickly as possible, and the ether pass into a receiver cooled by ice or water; continue to distill until a heavier fluid begins to pass over; then lower the heat, add another pound of spirit, and distill as before. Mix the distilled liquors together, pour off the supernatant portion, add 1 ounce carbonate of potassa (previously ignited), and agitate occasionally for one hour; finally, distill the ether from a large retort, and keep it in a well-stoppered bottle. This ether should have a specific gravity of .750.

It is recommended to mix only a portion of the alcohol at first with the acid, and as soon as it reaches boiling point (about 280° Fahr.), add the remainder only fast enough to replace the fluid as it distills over; also not to allow the heat to exceed 286°.

Another method is, to heat the sulphuric acid to 280°, and then introduce the alcohol in a fine stream, by means of a tube with a fine lower orifice, introduced through a cork fitted to the mouth of the retort; a thermometer being adjusted in a similar manner, so that its bulb is immersed in the contents of the retort. By this means the danger of the heat rising above 286° is obviated.

4281. Stronger Ether. *Officinal Æther Fortior.* Take 3 pints each of ether and water; shake them thoroughly together in a bottle; and, when the water has subsided, separate the ether from it, and agitate it well with 1 troy ounce each of chloride of calcium and lime, both in fine powder. After standing for 24 hours, decant the ether into a retort, with a Liebig's condenser, connected with a receiver surrounded by ice-cold water, and distill 1½ pints stronger ether, which should be of a specific gravity not exceeding .728.

4282. To Purify Ether. Ordinary ether is purified by first agitating it with 2 or 3 times its volume of distilled water containing a few grains of carbonate of potassa, or a few drops of milk of lime; and, after decantation, again agitated with a like quantity of water only. This may be used for inhalations. The washed ether is afterwards digested on chloride of calcium to deprive it of retained moisture.

4283. Cautions About Ether. The vapor of ether is very inflammable, and when mixed with atmospheric air it forms a violently explosive mixture. The density of this vapor is 2.586, that of air being 1, hence it rapidly sinks, and frequently accumulates in the lower parts of buildings, especially cellars which are badly ventilated. Every crack, every joint in the floors of rooms, the space beneath doors, &c., offer a road for the passage of this vapor, which, though invisible, as surely runs out of every orifice, and finds its level, as a stream of water would do. The only remedy is thorough ventilation. Many serious accidents have arisen from this cause; a light carried where such vapor is present causes an explosion.

4284. Ozone Ether. By agitating ether in a flask with binoxide of barium, adding gradually perfectly pure and very dilute hydrochloric acid, occasionally cooling and subsequently allowing the ether to settle, we obtain a liquid which has been recommended as a disinfecting, bleaching, and cleansing agent, and as a test for chromic acid, which it instantly turns indigo blue. According to Boettger, this does not contain ozone, but binoxide of hydrogen, which is equivalent to it.

4285. Tests for the Purity of Ether. Pure ether should be neutral to test paper; vaporize totally when exposed to the air; when shaken in a graduated tube with half its volume of a concentrated solution of chloride of calcium, its volume should not be lessened; water should dissolve only $\frac{1}{10}$ its volume of ether, and remain transparent. Dry carbonate of potassa or tannin shaken with ether in a test-tube will become moist or form a syrupy solution, in case any water is present. The presence of alcohol is shown by shaking the ether with water, its solubility in water being the greater in direct proportion to the quantity of alcohol which it contains.

4286. To Find the Percentage of Ether in a Mixture of Ether and Alcohol. By ascertaining the specific gravity at 60° Fahr. of a mixture of ether and alcohol, the following table will give the percentage of absolute ether contained in the mixture:

TABLE OF PERCENTAGE OF ETHER.

Spec. Grav.	Per cent.	Spec. Grav.	Per cent.
0.7198	100	.7673	65
.7246	95	.7636	60
.7293	90	.7701	55
.7343	85	.7772	50
.7397	80	.7840	45
.7455	75	.7880	40
.7514	70		

4287. Nitric Ether. Take 50 parts nitric acid, specific gravity 1.375, dissolve in it 2 or 3 parts nitrate of urea, and add 50 parts alcohol. Distill until ⅞ of the whole has passed over; agitate the distillate with a little water to separate the ether, and preserve the heavier portion. It has a specific gravity of 1.112; its vapor is explosive when strongly heated, consequently great care is necessary in the distillation, to keep the heat down to the lowest working point, and to distill only small quantities at a time. (*Millon.*) (*See directions for Sulphuric Ether, in No.* 4280.)

4288. Nitrous Ether. Nitrous or hyponitrous ether has a pale yellow color, boils at 62° Fahr.; at 60° its specific gravity is .947; it is very volatile. Take starch, 1 part; nitric acid, specific gravity 1.30, 10 parts; alcohol of 85 per cent., 2 parts; water, 1 part; introduce the starch and acid into a capacious retort connected with a wide tube 2 or 3 feet long, bent at right angles, and terminating near the bottom of a two-necked bottle, containing the alcohol and water mixed together, and surrounded with a freezing mixture or very cold water. The other neck of the bottle must be connected by a wide and long glass tube, with a good refrigerator or condenser. The heat of a water-bath must be cautiously applied to the retort, when pure hyponitrous acid will be set free, and, passing into the alcohol, will form hyponitrite of oxide of ethyl (ether), which will distill in a gentle stream. The tube connecting the retort and bottle must be cooled by means of a rag or moist paper, wetted from time to time with ice-cold water; for if the tube and the alcohol be not carefully cooled, the latter becomes spontaneously hot, and boils violently, when the product is vitiated. This process is very productive and economical, and yields perfectly pure hyponitrous ether. (*Liebig.*)

4289. Sweet Spirit of Nitre. This is an alcoholic solution of nitrous ether. The mixture should have, according to the U. S. Pharmacopœia, a specific gravity of .837. It becomes acid by age.

4290. Hydrochloric Ether. This is the chloride of ethyl, and is distilled in a retort, from rectified spirit of wine saturated with dry hydrochloric acid gas. (Thénard directs equal volumes of concentrated hydrochloric acid and absolute alcohol.) The retort is connected with a Wolffe's apparatus, the first bottle of which should be two-thirds full of tepid water (70° to 75° Fahr.), and the remainder surrounded with salt and ice. To render it perfectly anhydrous, it must be digested on a few fragments of fused chloride of calcium. (*Cooley.*)

4291. Acetic Ether. This is a colorless fluid, and bears a considerable resemblance to sulphuric ether, of which it is strictly an acetate. Liebig assigns it a specific gravity of .89 at 60° Fahr., dissolving in 7 times its bulk of water; Ure gives it a specific gravity of .866 at 45°, dissolving in 8 parts water. It is decomposed by alkalies and strong acids. (*Cooley.*) It is also called *acetate of ethyl.*

4292. To Obtain Acetic Ether. Mix together 3 parts acetate of potassa (or an equivalent quantity of acetate of soda (*see No.* 80), 3 parts 85 per cent. alcohol, and 2 parts strongest oil of vitriol. Distill them in a glass retort or earthenware still, connected with a well-cooled receiver; agitate the product with a little water, to remove undecomposed alcohol, then digest it with a little chalk, to remove acidity, and afterwards with fused chloride of calcium, to absorb water. Lastly, rectify by a gentle heat. (*Fownes.*)

4293. To Prepare Butyric Ether. This is the pine-apple oil of commerce; and, largely diluted with rectified spirit, is the pine-apple essence used for flavoring. It is prepared from crude butyric acid saponified with caustic potassa, and the resulting soap distilled along with alcohol and oil of vitriol. It is sparingly soluble in water, very soluble in alcohol; boils at 230°. It is also called *butyrate of ethyl.*

4294. Benzoic Ether. A colorless oily liquid, slightly heavier than water, aromatic in taste and odor. It boils at 410° Fahr. It is prepared as follows: Take 4 parts 90 per cent. alcohol, 2 parts crystallized benzoic acid, and 1 part concentrated muriatic acid; distill them together, and, as soon as the product turns milky when mixed with water, change the receiver and collect the subsequent distillate; add water to it, decant the ether from the surface of the water, and boil it with water and a little oxide of lead (to separate the benzoic acid); lastly, free it from water by allowing it to stand over chloride of calcium. Benzoic ether is also called *benzoate of ethyl.*

4295. Formic Ether—also called *formiate of ethyl,* is a limpid, aromatic fluid, lighter than water; soluble in 10 parts of that fluid; has a specific gravity of .915, and boils at 130° Fahr. To obtain it, mix in a retort, with a well-cooled receiver, 7 parts dry formiate of soda, 10 parts oil of vitriol, and 6 parts 90 per cent. alcohol. The greater part will distill over by the heat spontaneously developed, after which the heat of a water-bath may be applied. Purify it by agitation, first with milk of lime, and afterwards with chloride of calcium. (*Cooley.*)

4296. Œnanthic Ether—named also *œnanthylate of ethyl,* and *pelargonic ether* (*see No.* 1471)—is colorless, and has a powerful intoxicating vinous odor. Its specific gravity is .862, and boils at 480° Fahr. It is obtained towards the end of the distillation of fermented liquors, especially wines, and purified by agitation with a weak solution of carbonate of potassa. (*Cooley.*) This ether has the odor of quince, and dissolved in a due proportion of alcohol, forms *quince essence.*

4297. Chloric Ether. This is synonymous with chloroform. Medicinal chloric ether consists of 1 part chloroform in 8 parts rectified spirit.

4298. Ethyl. This is a colorless, inflammable gas, of a specific gravity a little over 2 (air standard). Under a pressure of 2¼ atmospheres, at 37.5 Fahr., it assumes the form of a colorless ethereal liquid. It forms the basis of ether, which is oxide of ethyl; and of alcohol, which is the hydrated oxide of ethyl; its usefulness lays chiefly in its compounds with acids. The following are the principal ones in use, and will serve as a guide for the preparation of most of the others.

4299. Acetate of Ethyl. Heat together in a retort, 3 parts acetate of potassium, 3 parts strong alcohol, and 2 parts oil of vitriol. The distilled product is mixed with water to separate the alcohol; digested first with a little chalk, and afterwards with fused chloride of calcium; lastly, it is rectified. A fragrant, limpid liquid, having a density of .890, and boiling at 165° Fahr. (*Fownes.*)

4300. Valerianate of Ethyl. Pass dry hydrochloric acid gas through an alcoholic solution of valerianic acid. Its odor resembles butyric ether.

4301. Amyl. This is the basis of the fusel oil compounds; fusel oil being the oxide of amyl. It is a colorless, ethereal liquid, boiling at 311° Fahr. Like ethyl, its acid compounds are most used. (*See No.* 1440.)

4302. Acetate of Amyl. Mix together 1 part fusel oil and 2 parts dry acetate of potassa (potassium—*Fownes*); add 1 part concentrated sulphuric acid, and distill. Purify the distillate by washing it with a dilute solution of potassa, and again distill it from dry chloride of calcium. (*Cooley.*) Acetate of amyl, diluted with alcohol, forms the *essence of Jargonelle or Bergamot pear.*

4303. Valerianate of Amyl. Mix carefully 4 parts fusel oil with 4 parts sulphuric acid; when cold, add 5 parts valerianic acid. Warm the mixture for a few minutes in a water-bath, then mix it with a little water, which causes the ether to separate. Purify this by washing it with water, and a weak solution of carbonate of soda. An alcoholic solution of valerianate of amyl constitutes *apple essence.*

4304. Methyl. This is the basis of methylic alcohol or pyroxylic spirit, forming compounds with the acids, analogous to those of ethyl.

4305. Valerianic Acid. A volatile, fatty acid, obtained by distilling valerian root along with water, and acting on the product with caustic potassa, when valerianate of potassa is formed, and a volatile oil is separated; by evaporating to dryness, the latter is dissipated, and the dry mixture, treated with dilute sulphuric acid and distilled, yields an aqueous solution of valerianic acid. By careful redistillation it may be deprived of water. Valerianic acid may also be produced artificially, by heating fused potassa along with the oil of potato, or corn spirit, when valerianate of potassa is obtained, the acid of which is identical in all respects with that obtained from the root of valerian. (*Liebig.*) It is colorless, limpid, oleaginous; boils at 270° Fahr.; soluble in alcohol and ether, and in 30 parts of water; smells strongly of valerian; with the bases it forms salts called VALERIANATES, most of which are soluble.

4306. Succinic acid. This is obtained by mixing coarsely powdered amber with an equal weight of sand, and distilling it by a gradually increased heat; the product is purified by pressing it between bibulous paper, to remove the oil, and then subliming it. It forms colorless, inodorous crystalline scales, soluble in 5 parts cold or 2½ parts boiling water; is fusible and volatile without decomposition. (*Cooley.*)

4307. Aldehyd-Ammonia. Take sulphuric acid, 6 parts; water, 4 parts; alcohol of 80 per cent., 4 parts; peroxide of manganese in fine powder, 6 parts. Dilute the acid with the water, then carefully add the alcohol, and next the manganese; agitate and distill with a gentle heat, from a spacious retort into a receiver surrounded with ice, and connected with the former perfectly air-tight. When 6 parts have distilled, re-distill this portion from its own weight of dried chloride of calcuim until 3 parts have come over, which must be again rectified in the same manner, until 1½ parts of liquid are obtained in the receiver. This liquid must then be mixed with an equal bulk of ether, and the mixture saturated with dry ammoniacal gas; brilliant colorless prismatic crystals will form, which, after washing with ether and drying, are pure aldehyd-ammonia. It smells like turpentine; melts at 160° Fahr.; volatilizes, unchanged, at 212°; decomposed by exposure to the air; soluble in most menstrua except ether.

4308. Aldehyde. Dissolve 8 parts aldehyd-ammonia in 8 parts water; place the solution in a retort, and add 7 parts sulphuric acid, diluted with about half its weight of water; then distill as directed in last receipt. Rectify the product twice from its own weight of dried muriate of lime, at a heat not exceeding 86° Fahr. It is an ethereous liquid, boiling at 72°; neutral, inflammable, mixed with water, alcohol, and ether; decomposed by exposure to the air, into liquid acetic acid; spoils by age.

4309. Sulphuret of Carbon. A colorless, pungent, fœtid liquid, exceedingly volatile and combustible. It exceeds all substances in refractive power. In dispersive power it exceeds all fluid substances except oil of cassia. It produces intense cold by its evaporation. A spirit thermometer, having its bulb covered with cotton, if dipped into this fluid and suspended in the air, rapidly sinks from 60° to 0°, and if put into the receiver of an air-pump it will fall to —81°. Mercury may be readily frozen in this way.

4310. To Prepare Sulphuret of Carbon. Heat together in a close vessel 5 parts bisulphuret of iron, and 1 part well dried charcoal; or transmit the vapor of sulphur over fragments of charcoal heated to redness in a porcelain tube. In either case the resulting compound should be carried off as soon as formed, by means of a glass tube plunged into pounded ice, beneath which it will collect. It may be afterwards freed from adhering moisture and sulphur by distilling it at a low temperature from chloride of calcium.

4311. Bisulphide or Bisulphuret of Carbon. This is used in the arts as a solvent for India-rubber, gutta percha, &c. To procure it, Mulder recommends the following process as the most convenient. Provide an iron bottle (a quicksilver bottle answers very well), and make a second opening into it. To one opening adapt a copper tube bent twice at right angles; and to the other a straight tube dipping into the bottle. Having nearly filled the bottle with pieces of charcoal (recently heated to redness), and having screwed on the bent and straight tubes, place the bottle in a furnace, closing the mouth of the latter with a stone or clay cover in two pieces, hollowed in the centre so as to fit the upper part of the bottle, and defend it from the action of the fire. Connect the curved tube with a Wolffe's bottle half-filled with water, and placed in a freezing mixture; and when the iron bottle is sufficiently heated, introduce by the straight tube fragments of sulphur, and immediately close the mouth of the tube with a plug. The bisulphuret, as it comes over, falls to the bottom of the water. Separate it from the water, and distill over dry chloride of calcium.

4312. Terpine. Leave oil of turpentine for a long time in contact with a mixture of nitric acid and alcohol. Crystals of terpine form. By boiling an aqueous solution of terpine with a small quantity of sulphuric or other acid, terpinole is formed, and may be separated by distillation.. It has the odor of hyacinths.

4313. Sugar Resin. Mix 16 parts strong sulphuric acid with 8 of the strongest nitric acid; when cooled to 70° Fahr., stir in 1 part of finely-powdered sugar. In a few seconds, when the sugar has become pasty, take it out of the acid and plunge it into cold water. Add more sugar to the acid, and proceed as before. Wash the resinous matter carefully, and dissolve it in alcohol or ether. Evaporate the solution with a gentle heat. It is very combustible. Its solution may be used to render gunpowder, lucifer matches, &c., waterproof.

4314. Aluminized Charcoal. This is recommended by Dr. Stenhouse as a cheap and very efficient decolorizing agent. Dissolve in water 54 parts of the sulphate of alumina of commerce, and mix with 92½ parts of finely powdered wood charcoal. When the charcoal is saturated, evaporate to dryness, and heat to redness in covered Hessian crucibles till the water and acid are dissipated. The charcoal contains just 7½ per cent. of anhydrous alumina.

4315. Styrol. Mix 20 parts of storax with 7 of carbonate of soda, and put them into a retort with water, and apply heat. A limpid fluid distills, which becomes, when heated to a certain point, a transparent solid.

4316. Turpentine. An oleo-resin flowing from the trunk, after removing the bark of the pitch or swamp pine. It is viscid, transparent, and of the consistence of honey.

4317. Oil of Turpentine. Oil or *spirits of turpentine* is obtained by distilling crude turpentine along with water. The remainder left in the still after distillation is *resin.* It congeals at 14°, and boils at 312° Fahr.; its specific gravity is about 870°. It is very inflammable, and becomes resinous by exposure to the air. When purified, by redistilling with 3 or 4 times its volume of water, it produces the *camphene* of commerce.

4318. Venice Turpentine. A liquid resin which exudes from the larch tree. The Venice turpentine usually met with is a factitious article composed of 2 gallons oil of turpentine added to 48 pounds melted black resin. (*Cooley.*)

4319. To Purify Turpentine. However carefully the oil of turpentine may have been distilled, it always leaves, after evaporation, a disagreeable odor, firmly adhering to the goods that have been treated with it. The same is the case with benzine and the lighter petroleum oils. This may be obviated, according to Bremer, by distillation over tannin. Articles treated with oil of turpentine that has been distilled in this way, are heated to 150° Fahr., when they lose every trace of odor. Bremer adds that this preparation is less inflammable, cheaper, and more agreeable to the workman than benzine.

4320. Benzine. This is the name given in the United States to one of the products distilled from petroleum, having a specific gravity of about .73, or 65° of Baumé's light hydrometer. (*See No.* 1527.) It has not yet been frozen, and is dangerously volatile at all temperatures. (*See No.* 346.) Benzine scarcely attacks asphaltum or pitch, and cannot (like benzole), be converted by nitric acid into nitro-benzole. It is consequently useless for the preparation of aniline. Benzine consists of about 84 per cent. carbon and 16 per cent. hydrogen. (*See No.* 440.)

4321. Benzole. In 1825, Faraday discovered a peculiar liquid which was deposited by condensation by ordinary coal-gas, and gave it the name of bicarburet of hydrogen. Some years afterwards Mitscherlich, of Berlin, obtained the same liquid from benzoic acid, and proposed for it the name of benzine. Faraday objected to this name, as too similar to the distinctive names of the alkaloids, as strychnine, morphine, &c., and decided to call it benzole. The French, however, adhered to Mitscherlich's name, and continue to call it benzine, causing considerable confusion; as benzole, from coal-tar, is a different liquid from benzine, obtained from petroleum. (*See No.* 1527.) Benzole has a specific gravity of .85, and freezes at 37° Fahr; it dissolves asphaltum or pitch rapidly, is volatile at all temperatures, but less so than benzine. Benzole can be converted by nitric acid into nitrobenzole, and, by further treatment, into aniline. (*See No.* 2552.) It contains about 92.5 per cent. of carbon, and 7.5 per cent. of hydrogen.

4322. Nitro-Benzole. A yellowish, oily fluid, insoluble in water; boils at 415° Fahr., and has a specific gravity of 1.209; known also as *essence of mirbane.* The method of preparing it is as follows: Place 10 parts fuming nitric acid in a tubulated retort capable of holding 3 times the quantity; apply heat sufficient to produce gentle ebullition. Insert a glass tube through the upper neck of the retort, and through it introduce by degrees, a drop at a time, benzole (not *benzine, see No.* 4321), so long as nitrous vapors are evolved; the liquid which passes into the receiver being poured back from time to time into the retort. When the red vapors have ceased to rise, distill off the excess of benzole, if any, from the acid. Then pour the contents remaining in the retort into 120 to 150 parts cold water, and let it stand for a few days, when the nitro-benzole will be found separated at the lower part of the vessel. Decant the upper stratum of acid, wash the nitrobenzole with water, and keep it in stoppered bottles. This substance is used as a *factitious oil of bitter almonds,* being, although poisonous, far less so than the prussic acid of which the real article consists. (*Hager.*)

4323. Urea. A crystalline, colorless, transparent substance, consisting of *cyanate of ammonia.* Fresh urine, gently evaporated to the consistence of a syrup, is to be treated with its own volume of nitric acid at 24 deg.; the mixture is to be shaken and immersed in an ice-bath to solidify the crystals of *nitrate of urea;* these are washed with ice-cold water, drained, and pressed between sheets of blotting paper. When they are thus separated from foreign matters, they are to be dissolved in water to which subcarbonate of potash is added, whereby the nitric acid is taken up, and the urea set at liberty. This new liquor is evaporated at a gentle heat, nearly to dryness; the residue is treated with pure alcohol, which only dissolves the urea; the solution is concentrated, and the urea crystallizes. (*Thénard.*)

Or: Mix 28 parts of perfectly dry ferrocyanide of potassium with 14 parts of black oxide of manganese, both pure and in fine powder; then place them on a smooth iron plate, and heat them to a dull red, over a charcoal fire. When the mass begins to burn, it must be frequently stirred; after which cool and dissolve in cold water, filter, and add 20½ parts of dry sulphate of ammonia, and decant the clear from the precipitated sulphate of potassa. Concentrate at a heat below 212°, again decant, evaporate to dryness, and digest in boiling alcohol of 80%; crystals of urea will be deposited as the solution cools. (*Liebig.*)

4324. Nitrate of Urea. This may be prepared as in last receipt from urea; or by saturating the artificial urea (Liebig's preparation) with nitric acid.

4325. Stearine. The solid portion of fats which is insoluble in cold alcohol. Pure strained mutton suet is melted in a glass flask with 7 or 8 times its weight of ether, and the solution allowed to cool; the soft pasty mass is then transferred to a cloth, and is strongly pressed, as rapidly as possible, to avoid evaporation; the solid portion is then dissolved again in ether, and the solution allowed to crystallize. The product is nearly pure.

4326. Iodine. A chemical element found both in the animal, vegetable, and mineral kingdoms, but exists in greatest abundance in sea-weed. It is principally manufactured from the mother-waters of kelp. Iodine is usually met with under the form of semi-crystalline lumps, having a metallic lustre, or friable scales, somewhat resembling gunpowder. It has a greyish-black color, a hot, acrid taste, and a disagreeable odor not much unlike that of chlorine. It fuses at 225° Fahr., volatilizes slowly at ordinary temperatures, boils at 347°, and when mixed with water rapidly rises along with its vapor at 212°. It dissolves in 7000 parts of water, and freely in alcohol and ether. It may be crystallized in large rhomboidal plates, by exposing to the air a solution of it in hydriodic acid. Iodine, like chlorine, has an extensive range of affinity; with the salifiable bases it forms compounds termed IODIDES, IODURETS, or HYDRIODATES; and it destroys vegetable colors.

4327. To Obtain Iodine. Saturate the residual liquor of the manufacture of soap from kelp (or other iodine lye) of a specific gravity of 1.374, heated to 230° Fahr., with sulphuric acid diluted with half its weight of water; cool, decant the clear, strain, and to every 12 fluid ounces add 1000 grains of black oxide of manganese, in powder; put the mixture into a glass globe, or matrass with a wide neck, over which invert another glass globe, and apply heat with a charcoal fire; iodine will sublime very copiously, and condense in the upper vessel, which, as soon as warm, should be replaced by another; and the two globes thus applied in succession as long as violet vapor arises. It may be washed out of the globes with a little cold water. A thin disc of wood, having a hole in its centre, should be placed over the shoulder of the matrass, to prevent the heat from acting on the globular receiver. On the large scale, a leaden still may be employed, and receivers of stoneware economically substituted for glass ones. The top of the leaden still is usually furnished with a moveable stopper, by which the process may be watched, and additions of manganese or sulphuric acid made, if required. The addition of the sulphuric acid should be made in a wooden or stoneware basin or trough. To render the iodine pure, it should be dried as much as possible, and then resublimed in a glass or stoneware vessel. (*Ure.*)

Or: Extract all the soluble part of kelp by water, and crystallize the soda by evaporation; to the mother-lye add oil of vitriol in excess, and boil the liquid, then strain it to separate some sulphur, and mix the filtered liquor with as much manganese as there was oil of vitriol: on applying heat, the iodine sublimes in the form of greyish-black scales, with a metallic lustre. The boiling is conducted in a leaden vessel; and a cylindrical leaden still with a very short head, and connected with 2 or 3 large globular glass rceivers, is used for the subliming apparatus. Care must be taken to watch the process, and prevent the neck of the still becoming choked with condensed iodine. (*Cooley.*)

4328. To Dissolve Iodine in Cod Liver Oil. To effect this it is best to triturate the iodine with half its weight of iodide of potassium, and to add gradually the oil so as to form a uniform mixture. After standing for a few hours all the iodide will be found at the bottom of the flask, leaving the iodine in perfect solution, the oil having but little of its taste. (*Eymael.*)

4329. Tests for Iodine. Free iodine may be recognized by — The violet color of its vapor.—Striking a blue color with starch; this test is so delicate that water containing only $\frac{1}{400000}$ part of iodine acquires a perceptible blue tinge on the addition of starch.—Nitrate of silver causes a white precipitate in solutions containing iodine.—It strikes a blue color with opium and narceine. Iodine in combination, as it exists in iodic acid and the iodates, does not strike a blue color with starch, without the addition of some deoxydizing agent, as sulphurous acid or morphia; and as it exists in the iodides, not until the base is saturated with an acid (as the sulphuric or nitric), when iodine being set free, immediately reacts upon the starch. An excess of either acid or alkali destroys the action of the test. By mixing the liquid containing the iodine with the starch and sulphuric acid, and lightly pouring thereon a small quantity of aqueous chlorine, a very visible blue zone will be developed at the line of contact. (*Balard.*) Solutions containing iodates yield, with nitrate of silver, a white precipitate, soluble in ammonia; the iodides, under the same circumstances, give a pale yellowish precipitate with nitrate of silver, scarcely soluble in ammonia; a bright yellow one with acetate of lead; and a scarlet one with bichloride of mercury. The iodates deflagrate when thrown on burning coals, but the iodides do not. The iodates may also be tested as iodides, by first heating them to redness, by which they lose their oxygen, and are converted into iodides.

4330. Kelp. The alkaline ashes obtained by burning various kinds of sea-weed.

4331. Galipot. A French term for that portion of turpentine which concretes on the trunk of the tree when wounded, and is removed during the winter.

4332. Phosphorus. Phosphorus is a pale yellow, semi-transparent, and highly combustible solid; specific gravity 1.77 (water standard); melts at 108° Fahr., and unites with oxygen, forming acids, and with the metals, forming PHOSPHIDES or PHOSPHURETS. It is soluble in ether, naphtha, and the oils. From its great inflammability it can only be safely kept under water. In commerce it is always packed in tin cylinders, soldered air-tight. It is a powerful corrosive poison. The specific gravity of its vapor is 4.327 (air standard).

4333. To Obtain Phosphorus. Ground bone-ash, 12 parts; water, 24 parts; mix to a pap in a large tub, and add in a slender stream (still stirring) oil of vitriol, 8 parts; work well together, adding more water if required; in 24 hours thin with water, agitate well, and, if convenient, heat the mixture in a leaden pan, and as soon as the paste has lost its granular character, transfer it into a series of tall casks; largely dilute with water, and, after settling, decant the clear portion; wash the residue well with water, mix the clear liquids, and evaporate in a copper or lead pan, till the calcareous deposit (gypsum) becomes considerable, then cool, decant the clear, and drain the sediment on a filter; evaporate the clear liquid to the consistence of honey (say to 4 parts), add 1 part of powdered charcoal, and evaporate to dryness in an iron pot, or till the bottom of the latter becomes red hot; the dry mixture, when cold, is put into earthen retorts well covered with luting and properly dried, and heat is applied sideways rather than at the bottom, by means of an air furnace. The beak of the retort is connected with a copper tube, the other end of which is made to dip about ¼ inch beneath the surface of lukewarm water placed in a trough or wide-mouthed bottle. The distilled product is purified by squeezing it through chamois leather under warm water, and is then moulded for sale by melting it under water heated to about 145° Fahr., plunging the wider end of a slightly tapering but straight glass tube into the water, sucking this up to the top of the glass, so as to warm and wet it, next immersing the end into the liquid phosphorus, and sucking it up to any desired height. The bottom of the tube being now closed with the finger, it is withdrawn, and transferred to a pan of cold water to congeal the phosphorus, which will then commonly fall out, or may be easily expelled by pressure with a piece of wire. Keep it in places where neither light nor heat has access, in phials filled with cold water which has been boiled, to expel all air, and enclose the phials in opaque cases.

4334. Baldwin's Phosphorus. Heat nitrate of lime till it melts; keep it fused for 10 minutes, and pour it into a heated iron ladle. When cool, break it into pieces, and keep it in a closely-stoppered bottle. After exposure to the sun's rays, it emits a white light in the dark.

4335. Canton's Phosphorus. Put calcined oyster shells in layers, alternately with sulphur, and heat strongly in a covered crucible for an hour. This is also luminous in the dark after exposure to the sun.

4336. Phosphorus Bottles. Put 12 grains phosphorus with ½ ounce olive oil in a 1 ounce phial; and place it, loosely corked, in a basin of hot water; as soon as the phosphorus is melted, remove the phial, cork it securely, and agitate it until nearly cold. On being uncorked it emits sufficient light in the dark to see the time by a watch, and will retain this property for some years if not too frequently employed.

4337. To Coat Phosphorus with Copper. Dr. Siewert, of Halle, suggests a method by which the sticks can be kept, even in the light, without undergoing deterioration. For this purpose, he takes advantage of the well-known property of phosphorus to reduce some metals from their solutions. The sticks of phosphorus are put into a cold saturated solution of the sulphate of copper. Presently they become coated with a deposit of metallic copper, and in this state resemble copper rods. They can now be removed to a bottle containing water, and will keep for years. When a stick is wanted for any purpose, on removing the metallic film, and scraping off a black deposit underneath it, the phosphorus will be found to have retained its translucency, as if it had been freshly cast.

4338. To Reduce Phosphorus to Powder. Melt the phosphorus in a phial containing some fresh urine, or a solution of pure urea, by the heat of hot water, and agitate until cold. Rectified spirit may be used instead of urine or urea. (*See No.* 1899.)

4339. Phosphorescent Oil. Dissolve 1 grain phosphorus in 1 ounce olive oil in a test tube by the heat of hot water, or add a larger quantity to some oil of lavender, in which it will dissolve spontaneously. Keep in a close phial.

4340. Pyrophorus. This is a term given to substances which inflame spontaneously when exposed to the air. When a small quantity of any of the powders given below is exposed to the air, it rapidly becomes hot and inflames. Their action is quicker in a damp atmosphere, or by the moisture of the breath.

4341. Homberg's Pyrophorus. Stir equal parts of alum and brown sugar (or 3 parts alum and 1 part wheat flour) in an iron ladle over the fire until dry; then put it into an earthen or coated glass phial, and keep it at a red heat so long as flame is emitted; it must then be carefully stopped up and cooled.

4342. Hare's Pyrophorus. Lampblack, 3 parts; burnt alum, 4 parts; carbonate of potash, 8 parts; as above.

4343. Gay Lussac's Pyrophorus. Sulphate of potash, 9 parts; calcined lampblack, 5 parts; as last.

4344. Goebel's Pyrophorus. Heat tartrate of lead red hot in a glass tube, and then hermetically seal it.

4345. Dextrine or Starch Gum. Heat 4 gallons water in a water-bath to between 77° and 86° Fahr.; stir in 1½ or 2 pounds finely ground malt; raise the temperature to 140°, add 10 pounds potato or other starch; mix all thoroughly, raise the heat to 158°, and keep it between that and 167° for 20 or 30 minutes. When the liquor becomes thin, instantly raise the heat to the boiling point, to prevent the formation of sugar. Strain the liquor, and evaporate it to dryness, as the dextrine will not keep long in a liquid form. Another method is to boil solution of starch with a few drops of sulphuric acid, filter the solution, and add alcohol to throw down the dextrine.

Or: Mix 500 parts potato starch with 1500 parts of cold distilled water and 8 parts of pure oxalic acid; place this mixture in a suitable vessel on a water-bath, and heat until a small sample tested with iodine solution does not produce the reaction of starch. When this is found to be the case, immediately remove the vessel from the water-bath, and neutralize the liquid with pure carbonate of lime. After having been left standing for a couple of days the liquor is filtered, and the clear filtrate evaporated upon a water-bath until the mass has become quite a paste, which is removed by a spatula, and, having been made into a thin cake, is placed upon paper and further dried in a warm place; 220 parts of pure dextrine are thus obtained. (*See No.* 2925.)

4346. Albumen. A substance which enters largely into the composition of animal bodies. It is scarcely soluble in water, but dissolves readily by adding to the water a small portion of caustic soda or potassa. White of egg is a solution of albumen.

4347. To Make Albumen. Expose the strained white of egg, or the serum of bullock's blood in a thin stratum, to a current of dry air, until it hardens into a solid transparent substance.

Or: Agitate strained white of egg with 10 or 12 times its bulk of alcohol, and collect the flocculent precipitate on a muslin filter. Dry it at a temperature not over 120° Fahr.

4348. Tests for Albumen. A solution of bichloride of mercury dropped into a fluid containing albumen, occasions a white precipitate. Tannin or tincture of galls gives a yellow, pitchy precipitate.

4349. Sulphur. Sulphur or *brimstone* is usually of a pale yellow color; melts to a clear, thin fluid, and volatile at about 232° Fahr., when it inflames spontaneously in the open air, and burns with a bluish flame. It is insoluble in water and in alcohol; soluble in turpentine and fat oils, and freely so in bisulphuret of carbon and hot liquor of potassa. With oxygen it forms sulphuric and sulphurous acids, and with the metals it combines as SULPHURETS or SULPHIDES. Its specific gravity is from 1.982 to 2.045 (water standard). The specific gravity of its vapor is 6.648 (air standard).

4350. Amorphous or Brown Sulphur. Prepared from sublimed sulphur by melting it, increasing the heat to 320° Fahr., and continuing it at that temperature for about 30 minutes, or until it becomes brown and viscid; it is then poured into water. It is now ductile like wax, may be easily moulded, and when cooled does not again become fluid below 600° Fahr.

4351. Precipitated Sulphur. Sublimed sulphur, 1 part; dry slacked lime, 2 parts; water, 25 parts; boil for 2 or 3 hours, dilute with 25 parts more water, filter, precipitate by muriatic acid, and drain; well wash, and dry the precipitate. Resembles sublimed sulphur in its general properties, but is much paler, and in a finer state of division.

4352. To Purify Precipitated Sulphur. The precipitated sulphur of the shops contains about two-thirds of its weight of sulphate of lime (plaster of Paris), owing to the substitution of sulphuric for muriatic acid in its preparation. This fraud is detected by heating a little of the suspected sample in an iron spoon or shovel, when the sulphur is volatilized, and leaves behind the sulphate of lime, which, when mixed with water and gently dried, gives the amount of the adulteration. A still simpler plan is to dissolve out the sulphur with a little hot oil of turpentine or liquor of potassa.

4353. Roll Sulphur. Crude sulphur, purified by melting and skimming it, is poured into cylindrical moulds. Common roll sulphur frequently contains from 3 to 7 per cent. of yellow arsenic.

4354. Sublimed Sulphur. Sometimes called *Flowers of Sulphur.* This is prepared by subliming sulphur in iron vessels. For medical purposes it is well washed with water and dried by a gentle heat. (*Cooley.*) An aqueous solution of pure anhydrous carbonate of soda will dissolve an appreciable quantity of flowers of sulphur, by digesting for 10 hours at 212° Fahr. (*Pole.*)

4355. Sulphur Vivum. Crude native sulphur, or *black sulphur*, is of a grey or mouse-colored powder. The same names are given to the residuum in the subliming pots, after the preparation of flowers of sulphur; it generally contains arsenic.

4356. Tersulphuret of Arsenic. The tersulphuret or *tersulphide of arsenic* is a fine golden yellow substance in lumps or powder. It is found, ready formed, in nature, or is prepared artificially by sublimation from arsenious acid and sulphur. The artificial sulphuret, *King's Yellow,* often contains 80 to 90 per cent. of white arsenic.

4357. Camphor. The camphor of commerce is a natural production. It is principally extracted from the laurel camphor tree, but it is also found in several other members of the vegetable kingdom. It is a white, semi-crystalline solid, very volatile at common temperatures; soluble in alcohol, ether, oils, and acetic acid, and slightly but sufficiently so in water to impart its characteristic smell and taste. The Chinese and Japanese extract the camphor by cutting the wood into small pieces, and boiling it with water in iron vessels—which are covered with large earthen capitals or domes—lined with rice straw. As the water boils, the camphor is volatilized along with the steam, and condenses on the straw, under the form of greyish granulations. In this state it is collected and transported to Europe, when it undergoes the process of refining into white camphor. To refine it, 100 parts of crude camphor are mixed with 2 parts each of quicklime and animal charcoal, and placed in a thin globular glass vessel sunk in a sand-bath. The heat is then cautiously applied, and the vessel gradually and carefully raised out of the sand as the sublimation goes on. When this is completed, the whole is allowed to cool. If the process be conducted too slowly, or at a heat under 375° Fahr., the product will be flaky, and consequently unsaleable, without remelting or subliming.

4358. To Pulverize Camphor. Camphor may be beaten in a mortar for some time, without being reduced to powder, but if it be first broken with the pestle, and then sprinkled with a few drops of spirit of wine, it may be readily pulverized. By adding water to an alcoholic or ethereal solution of camphor, it is precipitated under the form of an impalpable powder of exquisite whiteness, which may be collected and spontaneously dried on a filter; the addition of a minute quantity of carbonate of magnesia to the water (say 1 drachm for each 16 ounces of camphor), before mixing it with the camphor solution, will prevent the powdered camphor from hardening again after drying.

4359. Glycerine. This is a sweet, syrupy liquid, formed during the saponification of oils and fats. Its various uses will be found embodied in their respective receipts.

4360. To Obtain Commercial Glycerine. The sweet stearine liquor of the stearine manufacturers is used for this purpose. The lime contained in it is precipitated by a stream of carbonic acid gas, or by a solution of carbonate of soda, carefully avoiding adding the latter in excess; the liquor thus obtained is then boiled a little, filtered, and evaporated to a syrupy consistence. Glycerine is also obtained from the water and washings left in the manufacture of lead or litharge plaster, by mixing them together, filtering, and submitting them to the action of a stream of sulphuretted hydrogen, which precipitates the lead; the clear liquid, after settling, is decanted, filtered, and evaporated to the consistence of syrup, in a water-bath.

4361. Solvent Power of Glycerine. Klever gives the following parts of various chemicals soluble in 100 parts glycerine.

	PARTS.
Arsenious acid	20
Arsenic acid	20
Benzoic acid	10
Boracic acid	10
Oxalic acid	15
Tannic acid	50
Alum	40
Carbonate of ammonia	20
Muriate of ammonia	20
Tartrate of antimony and potassa	5.50
Atropia	3
Sulphate of atropia	33
Chloride of barium	10
Brucia	2.25
Sulphide of calcium	5
Quinine	.50
Sulphate of quinine	6.70
Tannate of quinia	.25
Acetate of copper	10
Sulphate of copper	30
Tartrate of iron and potassa	8
Lactate of iron	16
Sulphate of iron	25
Corrosive sublimate	7.50
Cyanide of mercury	27
Iodine	1.90
Morphia	.45
Acetate of morphia	20
Muriate of morphia	20
Phosphorus	.20
Acetate of lead	20
Arseniate of potassa	50
Chlorate of potassa	3.50
Bromide of potassium	25
Cyanide of potassium	32
Iodide of potassium	40
Arseniate of soda	50
Bicarbonate of soda	8
Borate of soda	60
Carbonate of soda	98
Chlorate of soda	20
Sulphur	.10
Strychnia	.25
Nitrate of strychnia	4
Sulphate of strychnia	22.50
Urea	50
Veratria	1
Chloride of zinc	50
Iodide of zinc	40
Sulphate of zinc	35

4362. To Purify Glycerine. Commercial glycerine is rendered pure by diluting it with water; it is then decolored with a little animal charcoal (*see No.* 1729), filtered, and evaporated to the consistence of a thin syrup, after which it is further evaporated in a vacuum, or over sulphuric acid, until it acquires a specific gravity of 1.265.

4363. To Purify Glycerine. Bottles sent out from wholesale and manufacturing houses, labeled, "Pure Glycerine," do not always contain what their labels declare. Some samples called pure are rich in lead, others contain chlorine, most are diluted with water, and the best is generally acid. It is necessary, therefore, to purify even the best samples by digesting them for several days with powdered chalk, allowing the latter to subside, and decanting. (*Schacht.*)

4364. Tests for the Purity of Glycerine. Pure glycerine has a neutral reaction, and on evaporation in a porcelain dish leaves only a very slight carbonaceous crust, while the impure has a much greater percentage of coaly matter. The pure article does not become brown when treated, drop by drop, with concentrated sulphuric acid, even after several hours; the impure becomes brown even when but slightly adulterated. Pure glycerine, treated with pure nitric acid and a solution of nitrate of silver, does not become cloudy, while the impure exhibits a decidedly milky appearance. Sometimes the impure article becomes blackened with the sulphide of ammonium. Oxalate of ammonia produces a black clouding; lime-water sometimes causes a milky discoloration. Pure glycerine, however, constantly remains perfectly uncolored, and clear as water, the impure becoming colored to a greater or less extent. If a few drops are rubbed between the fingers, pure glycerine causes no fatty smell; the contrary is the case with the impure, especially if a few drops of dilute sulphuric acid be introduced. (*Köller.*) (*See No.* 1151.)

4365. Gelatine. Animal jelly obtained by heat from the organic tissue of the bones, tendons, and ligaments, the cellular tissue, the skin, and the serous membranes in contact with water. Glue and size are coarse varieties of this substance, prepared from hoofs, hides, skins, &c.; and isinglass is a purer kind, prepared from the air-bladders and some other membranes of fish. Gelatine is insoluble in cold water, but dissolves with greater or less readiness on the application of heat, forming a tremulous and transparent jelly on cooling. It is insoluble in alcohol or ether, and is decomposed by strong alkali or acid.

4366. To Obtain Gelatine from Bones. The bones of good meat form most excellent materials for making soups and gravies, as is well known to every good cook. In France, soup is extensively made by dissolving bruised bones in a steam heat of 2 or 3 days' continuance, and also by dissolving out the earthy part by digestion in weak muriatic acid, when a lump of gelatine is obtained, which, after being well washed with water, will dissolve by boiling, and is equal to isinglass for all the purposes of making soups and jellies. Proust has recommended the following process for making bone gelatines: Crush the bones small, then boil them for 15 minutes in a kettle of water, cool, and skim the fat off, which is fit for all common purposes. The bones are then ground, and boiled in 8 to 10 times their weight of water, of which that already used must form a part, until evaporated to one-half, when a very nutritious jelly is obtained. A copper vessel should not be used, as the jelly acts upon this metal. An iron digester is the most suitable. The bones of boiled meat are nearly as productive as those of fresh meat, but roasted meat bones scarcely afford any jelly.

4367. Bone Gelatine. The bones are boiled to remove the fat, then digested in diluted muriatic acid till the earthy matter of the bone is dissolved. The gelatine, which retains the form of the bone, is washed in a stream of water, plunged in hot water, and again in cold, to remove all remains of acid, and sometimes put into a solution of carbonate of soda. When well washed, it is dried on open baskets or nets. By steeping the raw gelatine in cold water, dissolving it in boiling water, evaporating the jelly, and cutting it into tablets, it may be dried and preserved in that form.

4368. **Nelson's Patent Gelatine.** This is made from cuttings of the hides of cattle, and skins of calves. These, freed from hair, flesh, fat, &c., are washed and scoured, then macerated for 10 days in a lye of caustic soda, and afterwards placed in covered vessels at a temperature of 60° to 70° Fahr. until they become tender; then washed from the alkali, exposed to the vapor of burning sulphur until they become sensibly acid, dissolved in earthen vessels heated to 150°, strained, put into settling vessels heated to 100° or 120° for nine hours, the clear liquor drawn off and poured on the cooling slabs to the depth of ½ an inch. When cold, the jelly is cut in pieces, washed till free from acid, redissolved at 85°, poured on slabs, cut up, and dried on nets.

4369. **Gelatine Wafers.** Dissolve fine glue or isinglass in water, so that the solution, when cold, may be consistent. Pour it hot on a plate of glass (previously warmed with steam and slightly greased), fitted in a metallic frame whose edges are just as high as the wafers should be thick. Lay on the surface a second glass plate, also hot and greased, so as to touch every point of the gelatine while resting on the edges of the frame. By its pressure the thin cake is rendered uniform. When the glass plates have cooled, the gelatine will be solid, and may be removed. It is cut into discs of different sizes by means of proper punches.

4370. **Tests for Gelatine.** Gelatine dissolved in water is recognized by forming a jelly on cooling; it is precipitated by alcohol; corrosive sublimate throws down a whitish, flocculent precipitate; a solution of tannin, or an infusion of galls, gives a curdy, yellowish-white precipitate, which, on being stirred, coheres into an elastic mass, insoluble in water, and, when dry, assumes the appearance of over-tanned leather.

4371. **Asbestos.** A natural substance, resembling flax, capable of withstanding unchanged a considerable degree of heat; it may, therefore, be cleansed or purified by fire. It is also called *Amianthus.*

Tests or Reagents.

These are substances employed to determine the name or character of any other substance, or to detect its presence in compounds. They are used in both the solid and fluid state; generally the latter, when they are known as *liquid tests.* Their application as reagents is called *testing.* For this purpose they are commonly added drop by drop to the liquid to be tested, contained in a test-tube or test-glass. A simple way of employing them is to place a few drops or a small portion of the liquid or substance for examination on a slip of common white glass, and to add to them a drop of the test liquid. By placing the glass over a sheet of white paper, the effect will be rendered more perceptible.

A number of tests, not included here, referring to substances which hold a prominent place in some special process, have been introduced in immediate connection with the description of those substances, and will be found in the index under the head of the article to be tested.

4373. **Test for Chicory in Coffee.** Place a spoonful of ground coffee gently on the surface of a glass of cold water. The pure coffee will float for some time, and scarcely color the water; the chicory, if any be present, rapidly absorbs the water and sinks to the bottom, communicating a deep reddish-brown tint as it falls.

Or a spoonful of ground coffee may be placed in a small bottle of cold water, and shaken for a moment; if the sample of coffee is pure, it will rise to the surface and hardly tinge the water, whilst if the coffee is adulterated with chicory, the latter will fall to the bottom and color the water as before. A similar coloration of the water will be produced, however, if the coffee be adulterated with burnt sugar, which is the basis of the so-called "coffee essences or extracts."

4374. **To Test Tea.** Pure China tea is not turned black by being put into water impregnated with sulphuretted hydrogen gas, nor does it tinge spirit of hartshorn blue. The infusion is amber-colored, and is not reddened by adding a few drops of oil of vitriol to it.

4375. **To Detect Copper in Liquids.** Spirit of hartshorn turns them blue. Therefore tea has not been dried on copper if an infusion of it is not turned blue by this mixture. Cider, being passed through brass pots, is detected by this experiment.

4376. **To Detect Watered Milk.** The cheapest and easiest method of adulterating milk is by adding water, and we may readily ascertain the exact extent of adulteration by the following plan. If a glass tube, divided into 100 parts, be filled with milk and left standing for 24 hours, the cream will rise to the upper part of the tube, and occupy from 11 to 13 divisions, if the milk is genuine.

4377. **To Detect Chalk in Milk.** Dilute the milk with water; the chalk, if there be any, will settle to the bottom in an hour or two; put to the sediment an acid, vinegar for instance, and if effervescence take place it is chalk.

4378. **To Detect Mineral Substances in Flour.** The presence of a mineral adulteration of flour or meal may be readily detected. A small quantity of the suspected flour is shaken up in a glass tube with chloroform. All mineral adulterations will collect at the bottom, while the flour will float on the liquid.

4379. **How to Know Good Flour.** When flour is genuine or of the best kind, it holds together in a mass when squeezed by the hand, and shows the impressions of the fingers, and even of the marks of the skin, much longer than when it is bad or adulterated; and the dough made with it is very gluey, ductile, and elastic, easy to be kneaded; and may be flattened and drawn in every direction without breaking.

4380. To Detect Adulterations in Sugar. Sugar is largely adulterated. Pure cane and beet sugars may be known by their solutions bending the luminous rays in circumpolarization to the right, whereas grape and fecula sugars bend it to the left. Pure cane sugar boiled in a solution of caustic potassa remains colorless, but if starch sugar is present the liquid turns brown. A filtered solution of 33 grains cane or beet sugar in 1 ounce water, mixed with 3 grains pure caustic potassa, and then agitated with 1½ grains sulphate of copper in a close vessel, remains clear, even after the lapse of several days; but if starch sugar is present, a red precipitate is formed after some time, and if present in considerable quantity the copper will be wholly converted into oxide within 24 hours; the solution first turns blue or green, and then entirely loses its color. Of late years moist sugar has been largely adulterated with the sweet waste liquor (solution of glycerine) of the stearine manufactories; but this fraud may be detected by its inferior sweetness, and by its moist and dirty appearance.

4381. Test for Starch. The old and familiar test for starch is the blue color which free iodine produces when brought in contact with it; but this is not the only reagent by means of which we can detect the presence of starch in combination with similar bodies. Bromine is nearly as good as iodine, and tannin is said, in some instances, to be better. A solution of 50 grains tannin in ½ pint distilled water will answer for making the test. A drop of this tannin solution will cause a precipitate in extremely dilute solutions of starch; the precipitate dissolves when warmed and reappears when the solution cools; and where the starch paste is old, the reaction is said to be more sensitive than that of iodine.

4382. To Test Arrow-Root. Genuine arrow-root is odorless and tasteless, and produces a sort of crackling noise when pressed or rubbed, and emits no peculiar odor when mixed with muriatic acid. Stirred up in a mortar with double its weight of a mixture of equal parts of aqua-fortis and water, it does not become gelatinous and adhesive in less than 15 minutes.

4383. To Detect Arsenic in Colored Paper. Take a fragment of the paper and put it into a solution of ammonia. If arsenic be present the liquid will assume a bluish color. In case a further test is required, pour a little of the ammoniacal solution on crystals of nitrate of silver, and arsenic, if present, will show itself by leaving a yellow deposit on the crystals. As arsenic is used in coloring all qualities of paper, from the cheapest to the costliest, a knowledge of this test will be of service.

4384. To Detect Gum Arabic in Gum Tragacanth. Make the gum into a clear mucilage, and filter carefully; pour strong alcohol upon it, and if it retains its solubility and transparency, no gum arabic is present, but if it becomes opaque, or deposits a powder at the bottom, it contains gum arabic or some similar substance.

4385. To Test Slates. The test of a superior slate is its ability to remain unbroken, after being made red hot in a furnace and suddenly immersed in cold water while at that heat.

4386. To Test Silver or Gold. For testing gold or silver, slightly wet the metal and rub gently with lunar caustic. If genuine gold or silver the mark will be faint; but if an inferior metal it will be quite black.

4387. To Test Mushrooms. The following are said to be tests of the wholesomeness of mushrooms: Sprinkle a little salt on the spongy part or gills of the sample to be tried: if they turn yellow, they are poisonous; if black, they are wholesome.

False mushrooms have a warty cap, or else fragments of membrane adhering to the upper surface; are heavy, and emerge from a vulva or bag; they grow in tufts or clusters in woods, on the stumps of trees, &c.; whereas the true mushrooms grow in pastures.

False mushrooms have an astringent, styptic, and disagreeable taste; when cut they turn blue; they are moist on the surface, and are generally of a rose or orange color.

The gills of the true mushroom are of a pinky red, changing to a liver color; the flesh is white; the stem is white, solid, and cylindrical.

Introduce a silver spoon, or an onion, into a vessel in which mushrooms are seething; if, on taking either of them out, they assume a dark, discolored appearance, the circumstance denotes the presence of poison existing among them; if, on the other hand, the metal or onion, on being withdrawn from the liquor, wears its natural appearance, the fruit may be regarded as genuine, and of the right sort.

Rub the upper skin with a gold ring or any piece of gold: the part rubbed will turn yellow if it is a poisonous fungus.

4388. To Test the Hardness of Water. Hard water contains more or less carbonate of lime; the presence of this substance in waters is tested thus: Soap, or a solution of soap in proof spirit, mixes easily and perfectly with *pure* water, but is curdled and precipitated in water containing carbonates, chlorides, or sulphates. The degree of hardness of water depends on the amount of carbonate of lime held in it in solution, and is ascertained as follows: Dissolve 1 drachm finest white soap in 1 pint proof spirit; so adjust the strength (if not already so) that exactly 32 measures are required to be added to 100 measures of the standard solution of chloride of calcium (*see No.* 4786), before a lather can be produced. Every measure of this test solution of soap and alcohol, which is required to produce the same effect on 100 measures of a sample of hard water, represents ½ grain of carbonate of lime or ½° of hardness; 2 measures equal 1° of hardness or 1 grain of carbonate per gallon, &c.

4389. To Test the Purity of Borax. Its *strength* is best ascertained by the quantity of sulphuric acid required to neutralize a given weight of borax. (*See Alkalimetry.*) The *impurities* in borax are common salt and alum, which are mixed with it to lower the value.

Common salt may be detected by a solution of the borax in hot water yielding with nitrate of silver a curdy white precipitate which is soluble in ammonia; this must be distinguished from the white pulverulent precipitate of borate of silver which will be thrown down from pure borax.

The presence of alum is determined by addition of ammonia water to a solution of the borax giving a bulky white precipitate.

4390. To Test the Purity of Musk. Musk is often largely adulterated with dried blood, the presence of which may be detected by the inferiority of the odor; by an assay for the iron contained in the blood; or by microscopic examination. The ashes left after burning pure musk are neither red nor yellow, but grey, and should not exceed 6 per cent. of the amount burned.

4391. To Test the Purity of Ambergris. From the high price of the genuine ambergris, it is very frequently adulterated. When quite pure and of the best quality it is nearly wholly soluble in hot alcohol and ether, and yields about 85 per cent. of the odorous principle (ambreine). It is also easily punctured with a heated needle, and on withdrawing it not only should the odor be immediately evolved, but the needle should come out clean, without anything adhering to it.

4392. To Test Diamonds. If you have a doubtful stone, put it into a leaden or platinum cup, with some powdered fluor-spar and a little oil of vitriol; warm the vessel over some lighted charcoal, in a fireplace, or wherever there is a strong draught to carry away the noxious vapors that will be copiously evolved. When these vapors have ceased rising let the whole cool, and then stir the mixture with a glass rod to fish out the diamond. If you find it intact it is a genuine stone; but if it is false it will be corroded by the hydrofluoric acid that has been generated around it. A small paste diamond would disappear altogether under the treatment. This test is given by Massimo Levi, an Italian chemist.

4393. Test for the Presence of Blood. Gunning has discovered in acetate of zinc a reagent that precipitates the slightest traces of the coloring matter of blood from solutions, even where the liquids are so dilute as to be colorless. Blood washed from the hands in a pail of water can readily be detected in this way. The flocculent precipitate thrown down by acetate of zinc must be washed by decantation, and finally collected on a watch-glass, and allowed to dry, when the microscope will readily reveal crystals if any blood be present. (*See No.* 6415.)

4394. Test for the Presence of a Free Acid. Dissolve chloride of silver in just sufficient ammonia to make a clear solution. If a little of the test be added to ordinary spring water, the carbonic acid present in the latter will neutralize the ammonia and precipitate the chloride. The above forms a good lecture experiment, the test being a very delicate one.

4395. Permanganate of Potassa as a Test for Organic Matter. As a test for organic matter in air and water, its accuracy has been called in question, on the ground that it does not attack all kinds of organic matter with equal facility—some, as starch, resisting its action for a long time. It must be admitted, however, that it is, at present, the only practical test that we have, and certainly shows very rapidly and clearly the presence of hurtful organic matter in water or in air. It can be applied by any one, it being only necessary to use a weak solution; the disappearance of the color indicates the presence of organic matter. In time of epidemics, such as cholera or dysentery, this test might be of much value in singling out the contaminated from the pure water. It is, perhaps, well also to recall the fact that this test forms the readiest means of purifying foul water.

4396. Trommer's Test for the Presence of Sugar in Urine. Put some of the suspected urine into a large test-tube, and add a few drops of solution of sulphate of copper, then sufficient solution of potash to render it strongly alkaline. If sugar be present, the precipitated oxide redissolves into a blue liquid, and on boiling red oxide of copper is precipitated. White merino that has been wet with a solution of bichloride of tin is said to form a ready test for sugar in urine, &c. A portion wet with the suspected liquor, and exposed to 260° to 300° of heat, becomes blackened if sugar is present.

4397. Quantitative Test for Sugar in Urine. Dissolve 400 grains pure crystallized sulphate of copper in 1600 grains of distilled water; add this gradually to a solution of 1600 grains neutral tartrate of potash in a little water mixed with 6000 or 7000 grains solution of caustic soda of 1.12 specific gravity. Add water to make up the whole 11,544 grain measures. 1000 grain measures are equivalent to 5 grains of grape sugar.

4398. Pettenkofer's Test for Bile in Urine, &c. Put a small quantity of the suspected liquid into a test-tube, and add to it, drop by drop, strong sulphuric acid till it becomes warm, taking care not to raise the temperature above 122° Fahr. Then add from 2 to 5 drops of syrup, made with 5 parts sugar to 4 of water, and shake the mixture. If the liquid contain bile, a violet coloration is observed. Acetic acid, and those substances which are converted into sugar by sulphuric acid, may be substituted for sugar.

4399. To Detect Sulphur in Coal-Gas. The presence of sulphur in coal-gas can be proved in the following simple manner: Let a platinum basin be filled with a pint of water, and the basin be heated over a spirit lamp until all the liquid has evaporated; the basin will be found to be coated on the outside, where it has been struck by the flame, with a dirty, greasy looking substance, which, on being washed off with pure distilled water, and tested, proves to be sulphuric acid. The glass chimneys used with Argand gas-burners soon become coated over internally with a white substance, which, on being washed off with distilled water, will be found to be, on testing, sulphate of ammonia. The glass panes of a room wherein gas is burned for a few evenings consecutively, will, when rubbed with the fingers of a clean hand, impart to it a substance which, on the hand being rinsed in distilled water, will yield a precipitate of sulphate of baryta with chloride of barium, and a brick-red precipitate with potassio-iodide of mercury.

4400. Test for Benzole. For distinguishing genuine benzole, or that made of coal tar, from that prepared from petroleum, Brandberg recommends us to place a small piece of pitch in a testing tube, and pour over it some of the substance to be examined. The genuine will immediately dissolve the pitch to a tar-like mass, while that derived from petroleum will scarcely be colored. (*See Nos.* 4320 *and* 4321.)

4401. To Detect Cotton in Linen. Unravel a piece of the fabric, both warp and weft, and plunge it into a solution of aniline and fuchsine. This will dye the whole red. Take it out, wash it, and while moist dip into ammonia; the cotton threads will lose their color, while the linen will remain red. (*See No* 296, *&c.*)

4402. Hahnemann's Test for Lead in Wine. Take 1 ounce quick-lime, 1½ ounces flowers of sulphur; heat in a covered crucible for 5 or 6 minutes; take 2 drachms of this compound (which is *sulphuret of lime*), 2 drachms tartaric acid; powder, mix, and shake in a stoppered bottle with a pint of water; let it settle, pour off the clear liquid, and add 1½ ounces tartaric acid. The above test will throw down the least quantity of lead from wines, as a very sensible black precipitate.

4403. Paris Test for Lead in Wine. Expose equal parts of sulphur and powdered oyster shells to a white heat for 15 minutes, and, when cold, add an equal quantity of cream of tartar; these are to be put into a strong bottle, with common water, to boil for an hour, and the solution is afterwards to be decanted into ounce phials, adding 20 drops muriatic acid to each. Both the above tests will throw down the least quantity of lead from wines, as a very senible black precipitate. As iron might be accidentally contained in the wine, the muriatic acid is added, to prevent the precipitation of that metal. This acts in the same manner as Hahnemann's test. (*See No.* 4402.)

4404. To Distinguish Artificially Colored Wines. As the real coloring matter of wine is of difficult solubility in water free from tartaric acid, Blume proposes to make this fact of practical use in testing the purity of wine. A crumb of bread saturated in the supposed wine is placed in a plate of water; if artificially colored, the water soon partakes of the color; but if natural, a slight opalescence only will be perceptible after a quarter of an hour.

4405. To Detect Logwood in Wine. M. Lapeymere, having observed that hæmatine, the coloring principle of logwood, gives a sky-blue color in the presence of salts of copper, proposes the following test for logwood in wines: Paper is saturated with a strong solution of neutral acetate of copper, and dried. A strip of this is dipped into the suspected liquor, and, after removal, the adhering drops are made to move to and fro over the paper, which is finally to be carefully dried. If the wine contain logwood, the paper will assume a violet-blue color; but if the wine possess its natural coloring matter the paper will have a grey tint.

4406. To Detect Artificial Coloring in Wine. Use, as test liquid, a solution of potash and a solution of liquid ammonia and potash.

If the wine is colored by the coloring matter of the grape, potash changes the red color to a bottle green or brownish-green; ammonia changes the color to brownish-green or greenish-brown; a solution of alum to which some potash has been added gives a dirty grey precipitate.

If the wine is artificially colored, potash gives the following colored precipitates: Dwarf elder, mulberry, or beet root give a violet precipitate; pokeweed berries, a yellow; Indian wood, a violet red; pernambuco, a red; litmus, a violet blue; orchil or cudbear, a dirty lees color.

Or: Pour into the wine to be tested a solution of alum, and precipitate the alumina it contains, by adding potash, and the precipitates will have the same characteristic colors as above.

4407. Test for Rum. Dr. Wiederbold proposes the following method for distinguishing between true rum and the factitious liquid sold under this name: Mix a little of the rum to be tested with about a third of its bulk of sulphuric acid, and allow the mixture to stand. If the rum is genuine its peculiar odor remains after the liquid has cooled, and even after 24 hours' contact may still be distinguished. If, on the contrary, the rum is not genuine, contact with sulphuric acid promptly and entirely deprives it of all its aroma.

Test Papers. These consist of paper which has been wetted thoroughly and uniformly with a solution of some appropriate substance, dried and cut into convenient strips, and is used to test, by its change of color, the presence of some other substance known to produce that change. This is effected by dipping a strip of the proper test paper into, or wetting it with, the liquor to be tested, and the effect noted.

4409. Brazil-wood Test Paper. Made by preparing the paper with a decoction of Brazil-wood. Alkalies turn it purple or violet; strong acids, red.

4410. Buckthorn Test Paper. From a decoction of the berries; is reddened by acids.

4411. Cherry-juice Test Paper. From the juice of cherries; has the same properties as buckthorn paper.

4412. Dahlia Test Paper. Made from an infusion of the petals of the violet dahlia (georgina purpurea); alkalies turn it green; acids, red; strong caustic alkalies turn it yellow. This is a very delicate test paper. The juice of elderberries will make a similar test paper.

4413. Indigo Test Paper. From a solution of indigo; loses its color in contact with chlorine.

4414. Iodide of Potassium Test Paper. From a solution of it in distilled water; turned blue by an acidulated solution of starch.

4415. Starch and Iodine Test Paper. Prepared by mixing starch paste with iodide of potassium; turned blue by chlorine, ozone, and the mineral acids, and by the air containing them.

4416. Lead Test Paper. From a solution of either acetate or diacetate of lead; used as a test for sulphuretted hydrogen and hydrosulphuret of ammonia, which turn it black.

4417. Blue Litmus Test Paper. Triturate 1 ounce litmus in a wedgwood-ware mortar with 3 or 4 fluid ounces boiling water; put the mixture into a flask, and add more boiling water until the liquid measures fully ½ pint; agitate it frequently until cold, then filter it; divide the filtered fluid into 2 equal portions, stir one portion with a glass rod dipped into very dilute sulphuric acid, repeating this until the liquid begins to be very slightly tinged red, then add the other portion and mix them thoroughly. Prepare the paper with this infusion. Acids turn it red; alkalies, green. The neutral salts of most of the heavy metallic oxides redden this as well as the other blue test papers that are affected by acids.

4418. Red Litmus Paper. Treat the whole of a blue infusion, made as above, with the rod dipped in dilute sulphuric acid until it turns distinctly red. Alkalies, alkaline earths, and their sulphurets, restore its blue color; alkaline carbonates and the soluble borates produce the same effect. Red litmus paper may also be made by holding a strip of the blue litmus paper over a jar into which 2 or 3 drops of muriatic (hydrochloric) acid have been thrown.

4419. Mallow Test Paper. From an infusion of the purple flowers of the common mallow.

4420. Manganese Test Paper. From a solution of sulphate of manganese; turns black by contact with ozone.

4421. Rhubarb Test Paper. From a strong infusion of the powdered root; alkalies turn it brown, but boracic acid and its salts do not affect it.

4422. Rose Test Paper. Made with a strong infusion of the petals of the red rose; alkalies turn it a bright green.

4423. Starch Test Paper. From a cold decoction of starch; free iodine turns it blue.

4424. Sulphate of Iron Test Paper. Made with a solution of the protosulphate; as a test for hydrocyanic acid and the soluble cyanides.

4425. Turmeric Test Paper. Prepared with a decoction of 2 ounces turmeric to 1 pint water; is turned brown by alkalies, and by boracic acid and the soluble borates.

4426. Cabbage Test Paper. Make a strong infusion of red cabbage leaves, strain it, and evaporate it by a gentle heat till considerably reduced. Then dip the paper in it and dry it in the air. (This paper is of a greyish color; alkalies change it to green, acids to red. It is a very delicate test; if rendered slightly green by an alkali, carbonic acid will restore the color.)

4427. Alkanet Test Paper. The red principle of the alkanet root (Anchusa tinctoria, L.) is, as is well known, a most sensitive reagent for alkalies and acids; it is used for the preparation of test paper, and is prepared like litmus paper, by saturating unsized paper with a solution of the alkanet red. This is obtained by extracting dry alkanet root with ether; the filtered liquid is ready for use. The blue paper may be obtained from the red one by dipping it in an aqueous solution of carbonate of soda of specific gravity 1.5. A paper, answering for both alkaline and acid test, may be prepared by dividing the ethereal solution of alkanet red into two equal parts; to one is added, drop by drop, a watery solution of carbonate of soda, until the red just has changed to a distinct blue hue; then both liquids are mixed and used for the preparation of the paper. This, when dried, has to be kept in tightly closed bottles.

4428. Test Paper from Hollyhock Flowers. Some years ago Prof. Aiken, of the University of Maryland, proposed paper stained with an infusion of the petals, as a substitute for litmus paper. His althæa paper is purplish-blue when dry; acids impart a carmine hue, which is turned to bluish-green by alkalies, the neutral tint being purplish-blue; it is superior in intensity of reaction to turmeric, and quite equal to litmus, and is not affected by light, as is the case with the latter. The alkaline reaction is produced in natural or atmospheric waters; and the presence of nitrites, which change the red paper to purple, is indicated in greater dilution than with iodide starch.

4429. Ozonometer. This name has been given to paper prepared with a mixed solution of starch and iodide of potassium. It is white, but is turned blue by ozonized air when exposed to it in a slightly moistened state. This test is sufficiently delicate to detect the presence of ozone in the atmosphere.

Factitious Mineral Waters.

These are the imitations of different celebrated springs, whose waters have more or less medicinal properties; they are prepared by adding to pure water the ingredients which the original spring water is found, by chemical analysis, to contain. Under this class are also included the ordinary aerated or carbonated waters, which are known as soda waters. The majority, whether plain or medical, are charged with carbonic acid gas by the powerful apparatus employed by manufacturers of soda waters (*see No.* 718); the gas being evolved by the action of weak sulphuric acid on marble chalk, whiting, &c. Some few obtain their carbonic acid gas by the action of an acid and an alkali introduced into the bottle, and instantly corked. The quantity of gas introduced is usually about 5 times the volume of the liquid. In making chalybeate and sulphuretted water, the water should be previously boiled, to expel all air from it.

4431. Simple Aerated Water. Carbonic acid gas water. Water charged with five or more volumes of carbonic acid gas, by means of a suitable apparatus. (*See No.* 718.)

4432. Alkaline Aerated Waters. Aerated soda and potash waters should be made by dissolving 1 drachm of the carbonated alkali in each pint of water, and charging it strongly with carbonic acid gas. The soda water usually offered for sale contains little or no soda.

4433. Aerated Magnesia Water. This is a solution of magnesia of various strengths, charged with carbonic acid gas in the same manner as other aerated waters.

4434. Murray's Fluid Magnesia may be thus made: To a boiling solution of 16 ounces sulphate of magnesia in 6 pints water, add a solution of 19 ounces crystallized carbonate of soda in the same quantity of water; boil the mixture till gas ceases to escape, stirring constantly; then set it aside to settle; pour off the liquid, and wash the precipitate on a cotton or linen cloth, with warm water, till the latter passes tasteless. Mix the precipitate, without drying it, with a gallon of water, and force carbonic acid gas into it under strong pressure, till a complete solution is effected. The *Eau Magnésienne* of the French Codex is about a third of this strength; and some fluid magnesias prepared in this country are not much stronger. Dinneford's preparation is similar to the above.

4435. Carbonated Lime-Water—Carrara Water. Lime-water (prepared from lime made by calcining Carrara marble) is supersaturated, by strong pressure, with carbonic acid, so that the carbonate of lime at first thrown down is redissolved. It contains 8 grains carbonate of lime in 10 fluid ounces water.

4436. Aerated Lithia Water. This may be conveniently made from the fresh precipitated carbonate, dissolved in carbonated water, as directed for fluid magnesia. Its antacid and antilithic properties are found useful.

4437. Baden Water. Muriate of magnesia, 2 grains; muriate of lime, 40 grains; muriate of iron, ¼ grain (or 3 minims of the tincture); muriate of soda, 30 grains; sulphate of soda, 10 grains; carbonate of soda, 1 grain; water, 1 pint; carbonic acid gas, 5 volumes.

4438. Carlsbad Water. Dissolve 8 grains of muriate of lime, 1 drop of tincture of sesquichloride of iron, 50 grains of sulphate of soda, 60 grains of carbonate of soda, 8 grains of muriate of soda, in one pound of water.

4439. Carlsbad Water. Muriate of lime, 8 grains; tincture of muriate of iron, 1 drop; sulphate of soda, 50 grains; carbonate of soda, 60 grains; muriate of soda, 8 grains; carbonated water, 1 pint.

4440. Congress Water. Take common salt, 7¾ ounces; hydrate of soda, 23 grains; bicarbonate of soda, 20 grains; and calcined magnesia, 1 ounce. Add the above ingredients to 10 gallons of water, and charge with gas.

4441. Eger Water. Carbonate of soda, 5 grains; sulphate of soda, 4 scruples; muriate of soda, 10 grains; sulphate of magnesia, 3 grains; muriate of lime, 5 grains; carbonated water, 1 pint.

Or it may be made without apparatus thus: Bicarbonate of soda, 30 grains; muriate of soda, 8 grains; sulphate of magnesia, 3 grains; water, 1 pint; dissolve and add 1 scruple dry bisulphate of soda, and close the bottle immediately.

4442. Ems Water. Carbonate of soda, 2 scruples; sulphate of potash, 1 grain; sulphate of magnesia, 5 grains; muriate of soda, 10 grains; muriate of lime, 3 grains; carbonated water, 1 pint.

4443. Kissingen Water. Mix together bicarbonate of soda, 1 drachm; carbonate of lime, 8 scruples; precipitated carbonate of iron, 2 scruples; common salt, 8 ounces; muriate of ammonia, 4 grains; sulphate of soda, 8 scruples; sulphate of magnesia, 2 ounces; phosphate of soda, 13 grains; phosphate of lime, 8 scruples. Add water, ½ gallon. Let it stand half a day, filter, add carbonate of magnesia, 10 scruples, and 10 gallons water. Lastly, charge with gas by means of the usual apparatus. (*See No.* 718.)

4444. Marienbad Water. Carbonate of soda, 2 scruples; sulphate of soda, 96 grains; sulphate of magnesia, 8 grains; muriate of soda, 15 grains; muriate of lime, 10 grains; carbonated water, 1 pint.

Or, bicarbonate of soda, 50 grains; sulphate of soda, 1 drachm; muriate of soda, 15 grains; sulphate of magnesia, 10 grains; dissolve in 1 pint water, add 25 grains dry bisulphate of soda, and cork immediately.

4445. Marienbad Purging Salts. Bicarbonate of soda, 5 ounces; dried sulphate of soda, 12 ounces; dry muriate of soda, 1½ ounces; sulphate of magnesia, dried, 2 ounces; dried bisulphate of soda, 2½ ounces. Mix the salts, previously dried, separately, and keep them carefully from the air.

4446. Pullna Water. Sulphate of soda, 4 drachms; sulphate of magnesia, 4 drachms; muriate of lime, 15 grains; muriate of magnesia (dry), 1 scruple; muriate of soda, 1 scruple; bicarbonate of soda, 10 grains; water slightly carbonated, 1 pint. One of the most active of the purgative saline waters, and deserving of wider popularity.

It may be prepared without apparatus as follows: Bicarbonate of soda, 50 grains; sulphate of magnesia, 4 drachms; sulphate of soda, 3 drachms; muriate of soda, 1 scruple; dissolve in 1 pint of water; add, lastly, 2 scruples bisulphate of soda, and close the bottle immediately.

4447. Salts for Making Pullna Water. Dry bicarbonate of soda, 1 ounce; sulphate of soda, 2 ounces; sulphate of magnesia, 1½ ounces; muriate of soda, 2 drachms; tartaric acid, ¾ ounce (or rather, bisulphate of soda, 1 ounce). All the ingredients must be previously dried.

4448. Pyrmont Water. Carbonate of lime, 12 grains; crystallized carbonate of soda, 31 grains; sulphate of soda in crystals, 7¼ grains; sulphate of lime, 14 grains; sulphate of magnesia, 20 grains; sulphate of iron, 2 grains; chloride of sodium, 2 grains; chloride of magnesium, 4 grains; chloride of manganese, $\frac{1}{30}$ grain; water, 2 pints; carbonic acid, 5 volumes. Dissolve the sulphate of iron in part of the water; dissolve the other soluble salts in the remainder of the water, add the insoluble salts to the solution, and charge it with the carbonic acid. Mix the two solutions in a bottle, and cork it immediately.

4449 Seidlitz Water. This is usually imitated by strongly aerating a solution of 2 drachms sulphate of magnesia in 1 pint of water. It is also made with 4, 6, and 8 drachms of the salts to 1 pint of water, according to the strength required.

4450. Seidlitz Powders. The common Seidlitz powders do not resemble the water. A closer imitation would be made by using effloresced sulphate of magnesia instead of the potassio-tartrate of soda. A still more exact compound will be the following: Effloresced sulphate of magnesia, 2 ounces; bicarbonate of soda, ½ ounce; dry bisulphate of soda, ½ ounce; mix, and keep in a close bottle.

4451. Seidlitz Powders. Mix together thoroughly 1 troy ounce bicarbonate of soda, and 3 troy ounces Rochelle salt, both in fine powder, and divide into 12 equal parts. Divide 420 grains tartaric acid also into 12 equal parts. Put up the parts, severally, of the mixture and of the acid in separate papers, each kind of a distinctive color. (*U. S. Ph.*) The alkaline mixture is usually put up in blue, and the acid in white papers.

4452. Seidschutz Water. Sulphate of magnesia, 3 drachms; muriate of lime, nitrate of lime, bicarbonate of soda, of each 8 grains; sulphate of potash, 5 grains; aerated water, 1 pint.

4453. Seltzer or Selters Water. The seltzer water, as commonly sold, is prepared as follows: Prepare a solution of fused chloride of calcium, 1 part in 9 of water (specific gravity should be 1.088 to 1.089); a solution of calcined carbonate of soda, 1 part in 10 of water (specific gravity 1.105); a solution of chloride of magnesium, by dissolving calcined magnesia at the rate of 20 grains in dilute hydrochloric acid to make 1 fluid ounce of saturation (specific gravity 1.086); lastly, a solution of dry sulphate of soda in 10 parts water (specific gravity 1.092). These solutions are mixed with water in the following proportions: Solution of carbonate of soda, 1000 grains; solution of chloride of calcium, 200 grains; solution of chloride of magnesium, 150 grains; solution of sulphate of soda, 20 grains; added to 250 to 300 ounces (troy) of water, afterwards to be charged with carbonic acid.

4454. Seltzer Water. Muriate of lime and muriate of magnesia, of each 4 grains; dissolve these in a small quantity of water, and add it to a similar solution of 8 grains bicarbonate of soda, 20 grains muriate of soda, and 2 grains phosphate of soda; mix, and add a solution of ¼ of a grain sulphate of iron; put the mixed solution into a 20-ounce bottle, and fill up with aerated water. An imitation of seltzer water is also made by putting into a stone seltzer bottle, filled with water, 2 drachms bicarbonate of soda and 2 drachms citric acid in crystals, corking the bottle immediately.

4455. Vichy Water. Sulphate of potassa, 2 drachms; sulphate of soda, 4 scruples; phosphate of soda, 25 grains; common salt, 6 drachms; bicarbonate of soda, 5¼ ounces; carbonate of ammonia, 10 grains. Mix. Add water, ½ gallon. Let it stand half a day; filter, add 10 gallons water, and charge with gas.

4456. Vichy Water. Bicarbonate of soda, 1 drachm; muriate of soda, 2 grains; sulphate of soda, 8 grains; sulphate of magnesia, 3 grains; tincture of muriate of iron, 2 drops; aerated water, 1 pint. Dorvault directs 75 grains of bicarbonate of soda, 4 grains of chloride of sodium, ⅛ grain sulphate of iron, 10 grains sulphate of soda, and 3 grains sulphate of magnesia, to a pint of water. By adding 45 grains (or less) of citric acid, an effervescing water is obtained.

4457. Vichy Water. Soubeiran, relying on the analysis of Longchamps, imitates Vichy water by the following combination: Bicarbonate of soda, 135 grains; chloride of sodium, 2½ grains; crystallized chloride of calcium, 12 grains; sulphate of soda, 11½ grains; sulphate of magnesia, 3¾ grains; tartrate of iron and potash ⅛ grain; water, 2⅒ pints; carbonic acid, 305 cubic inches (10½ pints). Dissolve the salts of soda and iron in part of the water, dissolve and add the sulphate of magnesia, and then the chloride of calcium in the remaining water. Charge now with the carbonic acid gas under pressure.

4458. Vichy Salts. Bicarbonate of soda, 1½ ounces; muriate of soda, 15 grains; effloresced sulphate of soda, 1 drachm; effloresced sulphate of magnesia, 1 scruple; dry tartarized sulphate of iron, 1 grain; dry tartaric acid, 1 ounce (or dry bisulphate of soda); mix the powders, previously dried, and keep them in a close bottle.

4459. Sea-Water. Muriate of soda, 4 ounces; sulphate of soda, 2 ounces; muriate of lime, ¼ ounce; muriate of magnesia, 1 ounce; iodide of potassium, 4 grains; bromide of potassium, 2 grains; water, 1 gallon. A common substitute for sea-water as a bath is made by dissolving 5 or 6 ounces of common salt in a gallon of water.

4460. Dry Salt to Imitate Sea-Water. The following mixture of dry salts may be kept for the immediate production of a good imitation of sea-water. Chloride of sodium (that obtained from evaporating sea-water and not recrystallized, in preference), 85 ounces; effloresced sulphate of soda, 15 ounces; dry muriate of lime, 4 ounces; dry muriate of magnesia, 16 ounces; iodide of potassium, 2 drachms; bromide of potassium, 1 grain. Mix and keep dry. Put 5 or 6 ounces to a gallon of water.

4461. Balaruc Water. Muriate of soda, 1 ounce; muriate of lime, 1 ounce; muriate of magnesia, ½ ounce; sulphate of soda, 3 drachms; bicarbonate of soda, 2 drachms; bromide of potassium, 1 grain; water, 1 gallon. Chiefly used for baths.

4462. Simple Sulphuretted Waters. Pass sulphuretted hydrogen into cold water (previously deprived of air by boiling, and cooled in a close vessel), till it ceases to be absorbed.

4463. Aix-la-Chapelle Water. Bicarbonate of soda, 12 grains; muriate of soda, 25 grains; muriate of lime, 3 grains; sulphate of soda, 8 grains; simple sulphuretted water, 2½ ounces; water slightly carbonated, 17½ ounces.

4464. Bareges Water. (*Cauterets, Bagnères de Luchon, Bonnes St. Sauveur,* may be made in the same manner.) Crystallized hydrosulphate of soda, crystallized carbonate of soda, and chloride of sodium, of each 2½ grains; water (free from air), 1 pint. A stronger solution for adding to baths is thus made: Crystallized hydrosulphate of soda, crystallized carbonate of soda, and muriate of soda, of each 2 ounces; water, 10 ounces; dissolve. To be added to a common bath at the time of using.

4465. Naples Water. Crystallized carbonate of soda, 15 grains; fluid magnesia, 1 ounce; simple sulphuretted water, 2 ounces; aerated water, 16 ounces. Introduce the sulphuretted water into the bottle last.

4466. Harrogate Water. Chloride of sodium, 100 grains; muriate of lime, 10 grains; muriate of magnesia, 6 grains; bicarbonate of soda, 2 grains; water, 18½ ounces. Dissolve and add simple sulphuretted water, 1½ ounces.

4467. Simple Chalybeate Water. Water, freed from air by boiling, 1 pint; sulphate of iron, ½ grain.

4468. Aerated Chalybeate Water. Sulphate of iron, 1 grain; carbonate of soda, 4 grains; water, deprived of air and charged with carbonic acid gas, 1 pint. Dr. Pereira recommends 10 grains each of sulphate of iron and bicarbonate of soda to be taken in a bottle of ordinary soda-water. This is equivalent to 4 grains of carbonate of iron.

4469. Brighton Chalybeate. Sulphate of iron, muriate of soda, muriate of lime, of each 2 grains; carbonate of soda, 3 grains; carbonated water, 1 pint.

4470. Bussang Water. Dissolve from ½ to ⅔ grain of sulphate of iron, 2 or 3 grains carbonate of soda, 1 grain sulphate of magnesia, and 1 of muriate of soda, in a pint of aerated water. *Forges*, *Provins*, and other similar waters can be imitated in the same manner.

4471. Mont d'Or Water. Bicarbonate of soda, 70 grains; sulphate of iron, ⅔ grain; muriate of soda, 12 grains; sulphate of soda, ½ grain; muriate of lime, 4 grains; muriate of magnesia, 2 grains; aerated water, 1 pint. (*See No.* 4431.)

4472. Passy Water. Sulphate of iron, 2 grains; muriate of soda, 3 grains; carbonate of soda, 4 grains; muriate of magnesia, 2 grains; aerated water, 1 pint.

4473. Pyrmont Water. Sulphate of magnesia, 20 grains; muriate of magnesia, 4 grains; muriate of soda, 2 grains; bicarbonate of soda, 16 grains; sulphate of iron, 2 grains; Carrara water, 1 pint. (*See No.* 4435.)

4474. Mialhe's Aerated Chalybeate Water. Water, 1 pint; citric acid, 1 drachm; citrate of iron, 15 grains; dissolve, and add 75 grains bicarbonate of soda.

4475. Trousseau's Martial Aerated Water. Potassio-tartrate of iron, 10 grains; artificial Seltzer water, 1 pint.

4476. Bouchardat's Gaseous Purgative. Phosphate of soda, 1½ ounces; carbonated water, 1 pint.

4477. Mialhe's Ioduretted Gaseous Water. Iodide of potassium, 15 grains; bicarbonate of soda, 75 grains; water, 1 pint; dissolve, and add sulphuric acid diluted with its weight of water, 75 grains. Cork immediately.

4478. Dupasquier's Gaseous Water of Iodide of Iron. Solution of iodide of iron (containing 10 per cent. of dry iodide), 30 grains; syrup of gum, 2½ ounces; aerated water, 17½ ounces.

Medicinal Tinctures.

These are solutions of the active principles of bodies, obtained by digesting them in alcohol more or less dilute. Ethereal tinctures are similar solutions prepared with ether. (*See Nos.* 35, *&c.*) Where percolation is resorted to in the preparation of tinctures, the directions laid down in No. 41 should be carefully followed to ensure success.

4480. Tincture of Assafetida. Macerate 4 troy ounces assafetida in 2 pints alcohol for 2 weeks, and filter through paper. (*U. S. Ph.*)

4481. Tincture of Aconite Leaf. Take 4 troy ounces recently dried aconite leaf in fine powder; moisten with 2 fluid ounces diluted alcohol; pack it firmly in a conical percolator, and gradually pour diluted alcohol sufficient to displace 2 pints of tincture. (*U. S. Ph.*)

4482. Tincture of Aconite Root. Take 12 troy ounces aconite root in fine powder; moisten with 6 fluid ounces alcohol; pack it firmly in a cylindrical precolator, and gradually pour alcohol upon it until 2 pints of tincture are obtained. (*U. S. Ph.*)

4483. Tincture of Arnica. Take 6 troy ounces tincture of arnica; mix 1½ pints alcohol and ½ pint water; moisten the arnica slightly with this mixture, and bruise it thoroughly in a mortar. Then pack it firmly in a cylindrical percolator, and pour upon it first the remainder of the mixture, and afterwards sufficient diluted alcohol to make the tincture measure 2 pints. (*U. S. Ph.*)

4484. Tincture of Belladonna. Moisten 4 troy ounces recently dried belladonna leaf, in fine powder, with 2 fluid ounces diluted alcohol; pack it firmly in a conical percolator, and gradually pour diluted alcohol upon it until 2 pints of tincture are obtained. (*U. S. Ph.*)

4485. Tincture of Hemp. Dissolve 360 grains purified extract of hemp in 1 pint alcohol, and filter through paper. (*U. S. Ph.*)

4486. Tincture of Capsicum. Moisten 1 troy ounce capsicum, in fine powder, with ½ fluid ounce diluted alcohol; pack it in a conical percolator, and gradually pour diluted alcohol upon it until 2 pints of tincture are obtained. (*U. S. Ph.*)

4487. Tincture of Cinchona. Moisten 6 troy ounces yellow cinchona, in moderately fine powder, with 2 fluid ounces diluted alcohol; pack it firmly in a glass percolator and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4488. Compound Tincture of Cinchona. Take 4 troy ounces red cinchona, 3 troy ounces bitter orange peel, 6 drachms serpentaria (Vinginia snakeroot), 3 drachms red saunders, all in moderately fine powder; and 3 drachms saffron in moderately coarse powder. Mix the powders, moisten with 4 fluid ounces diluted alcohol, pack it firmly in a glass percolator, and displace, with diluted alcohol, 2¼ pints of tincture. (*U. S. Ph.*)

4489. Tincture of Hemlock. Moisten 4 troy ounces recently dried hemlock, in fine powder, with 2 fluid ounces diluted alcohol; pack it firmly in a conical percolator, and gradually pour diluted alcohol upon it until 2 pints of tincture are obtained. (*U. S. Ph.*)

4490. Tincture of Digitalis. Moisten 4 troy ounces recently dried digitalis (fox glove), in fine powder, with 2 fluid ounces diluted alcohol; pack it firmly in a conical percolator, and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4491. Tincture of Iodine. Dissolve 1 ounce iodine in 1 pint alcohol. (*U. S. Ph.*) Tincture of iodine may be readily prepared by placing the iodine in a glass funnel, having previously filled the neck with broken glass, and pouring on the alcohol as it passes through. To prevent evaporation, cover the funnel with a close-fitting glass top. *Spirits of camphor* may also be speedily made in this way.

4492. Tincture of Turkey-Corn. Take 3 ounces powdered Turkey-corn root (corydalis) and make 1 pint tincture by maceration or displacement with diluted alcohol. (*Am. Dis.*)

4493. Tincture of Yellow Jasmine (Gelseminum). Cut into small pieces 8 ounces of the fresh root of yellow jasmine (gelseminum); macerate for 14 days in 2 pints diluted alcohol, express and filter. This forms a saturated tincture. (*Am. Dis.*)

4494. Universal Tincture. Bruise the following ingredients and digest for several days in 18 ounces brandy: 10 drachms aloes; 8 drachms each white agaric, rhubarb root, zedoary root, gentian root, galanga root, gum myrrh, and molasses electuary; 2 drachms saffron, and 4 ounces sugar. Express and filter.

4495. Compound Tincture of Black Pepper. This is prepared with 30 parts capsicums; 40 parts black pepper; 15 parts each grains of paradise, cinnamon, ginger, and calamus; 15 parts by measure acetate of potassa, and 60 parts alcohol.

4496. Tincture of American Hellebore. Moisten 16 troy ounces American Hellebore (veratrum viride), in moderately fine powder, with 4 fluid ounces alcohol. Pack it firmly in a cylindrical percolator, and displace, with alcohol, 2 pints of tincture. (*U. S. Ph.*)

4497. Compound Tincture of Dewberry. Take 4 ounces Dewberry (rubus trivialis) root, ½ ounce powdered Aleppo galls, 3 drachms powdered cinnamon, 10 grains powdered capsicum, 1 drachm powdered cloves, and ½ ounce gum kino. Digest for 14 days in 2 pints best brandy. Filter, and add 1 ounce tincture of opium, 1 ounce essence of peppermint, and 1 pint white sugar. Dose, 1 tea-spoonful for an adult.

4498. Tincture of Skunk-Cabbage. Take 3 ounces skunk-cabbage root in powder, and 1 pint diluted alcohol. Make a tincture by maceration, or displace 1 pint from a percolator. (*Am. Dis.*)

4499. Tincture of Stramonium. Make 1 pint of tincture from 2 ounces bruised stramonium seed and diluted alcohol. (*Am. Dis.*)

4500. Tincture of Monesia. Take 1 part extract of monesia, 6 parts alcohol, and 14 parts water. Mix and filter. (*Am. Dis.*)

4501. Tincture of St. John's Wort. Macerate for 14 days 5 ounces blossoms of St. John's wort, in 1 pint alcohol. Express and filter. (*Am. Dis.*)

4502. Compound Tincture of Kino. Take 4 drachms each powdered opium, gum kino, and cochineal; 3 drachms each camphor and cloves; and 4 drachms aromatic spirits of ammonia. Macerate in 4 pints dilute alcohol. Express and filter.

4503. Camphorated Tincture of Soap. There has been some difficulty in preparing this liniment as directed in the dispensatory, on account of its coagulating. The following formula makes a tincture which remains fluid at all temperatures. Take 4 ounces castile soap, 2 ounces camphor, ½ ounce oil of rosemary, 16 ounces water, and 20 ounces 95 per cent. alcohol.

4504. Tincture of Chloride of Iron. Introduce 3 troy ounces of iron wire, cut into pieces, into a flask of the capacity of 2 pints; pour upon it 11 troy ounces muriatic acid, and allow the mixture to stand until effervescence has ceased. Then heat it to the boiling point, decant the liquid from the undissolved iron, filter it through paper, and, having rinsed the flask with a little boiling distilled water, add this to it through the filter. Pour the filtrate into a 4-pint capsule, add 6½ troy ounces muriatic acid; and, having heated the mixture nearly to the boiling point, add 1½ troy ounces nitric acid. When effervescence has ceased, drop in nitric acid, constantly stirring, until it no longer produces effervescence. Lastly, when the liquid is cold, add sufficient distilled water to make it measure 1 pint, and mix it with 3 pints alcohol. (*U. S. Ph.*)

4505. Tincture of Guaiac. Reduce 6 troy ounces guaiac to a moderately coarse powder, mix it with an equal bulk of dry sand, pack the mixture moderately in a conical percolator; and, having covered it with a layer of sand, gradually pour alcohol upon it until 2 pints of tincture are obtained. (*U. S. Ph.*)

4506. Tincture of Black Hellebore. Moisten 4 troy ounces black hellebore in moderately fine powder, with 1 fluid ounce diluted alcohol. Pack it in a cylindrical percolator, and gradually pour diluted alcohol upon it until 2 pints of tincture are obtained. (*U. S. Ph.*)

4507. Tincture of Mandrake (Podophyllin). Make 1 pint of tincture from 3 ounces mandrake-root in powder, with alcohol, either by maceration or percolation. (*Am. Dis.*)

4508. Tincture of Queen's Root (Stillingia). Take 3 ounces queen's root, bruised and cut into small pieces, and make 1 pint with diluted alcohol, either by maceration or displacement. (*Am. Dis.*)

4509. Tincture of Leopard's Bane (Arnica Flowers). Macerate 2 ounces arnica flowers in 1 pint dilute alcohol; or put the arnica-flowers in a percolator, and with diluted alcohol displace 1 pint. (*Am. Dis.*)

4510. Tincture of Hops. Moisten 5 troy ounces hops, in moderately coarse powder, with 2 fluid ounces diluted alcohol. Pack it very firmly in a cylindrical percolator, and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4511. Tincture of Henbane. Moisten 4 troy ounces henbane leaf, in fine powder, with 2 fluid ounces diluted alcohol. Pack it firmly in a conical percolator, and gradually pour diluted alcohol upon it until 2 pints of tincture are obtained. (*U. S. Ph.*)

4512. Tincture of Kino. Reduce 6 drachms kino to fine powder. Mix the powdered kino thoroughly with an equal bulk of dry sand; introduce the mixture into a conical glass percolator, and displace ½ pint of tincture, using a menstruum composed of 2 parts alcohol and 1 part water. (*U. S. Ph.*)

4513. Tincture of Lobelia. Moisten 4 troy ounces lobelia, in fine powder, with 2 fluid ounces diluted alcohol; pack it firmly in a conical percolator, and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4514. Tincture of Cimicifuga Racemosa (Black Cohosh, or Black Snake-Root). Black cohosh root, in fine powder, 4 troy ounces; alcohol, 1 pint. Make 1 pint of tincture by maceration or displacement. (*Am. Dis.*)

4515. Norwood's Tincture of Veratrum Viride (American Hellebore). Macerate 8 ounces of the recently dried, coarsely powdered root, in 16 ounces of alcohol for 14 days; express and filter through paper. (*Am. Dis.*)

4516. Tincture of Chiretta. Macerate 2½ ounces (avoirdupois) chiretta, cut small and bruised, in 15 Imperial fluid ounces rectified spirit, for 48 hours. Then transfer to a percolator, pouring on 5 additional fluid ounces rectified spirit; press the residuum, and filter; lastly, add rectified spirit to make up to 1 Imperial pint. (*B. Ph.*)

4517. Tincture of Ergot. Take 5 ounces (avoirdupois) ergot, and proceed in the same manner as for tincture of chiretta. (*B. Ph.*)

4518. Tincture of Blue-Flag. Macerate 3 ounces powdered blue-flag in 1 pint alcohol; or, make 1 pint by percolation. (*Am. Dis.*)

4519. Tincture of Lupulin. Pack 4 troy ounces lupulin in a narrow cylindrical percolator, and gradually pour alcohol upon it until 2 pints of tincture are obtained. (*U. S. Ph.*)

4520. Tincture of Nux Vomica. Digest with a gentle heat, 8 troy ounces finely powdered nux-vomica in 1 pint alcohol, for 24 hours in a close vessel. Then transfer the mixture to a cylindrical percolator, and gradually pour alcohol upon it until 2 pints of tincture are obtained. (*U. S. Ph.*)

4521. Tincture of Tobacco. Take a convenient quantity of the expressed juice of fresh-gathered tobacco leaves; mix it with an equal quantity of rectified spirits, and filter the mixture. This tincture, diluted with half its weight of spirits of nitric ether, is a specific for cramps or spasms of the bladder. For this purpose it is administered in doses of 10 to 20 drops, at intervals of about 2 hours.

4522. Tincture of Rhubarb. Mix together 3 troy ounces rhubarb in moderately coarse powder, and ½ troy ounce cardamom in moderately fine powder; moisten with 1 fluid ounce diluted alcohol, pack moderately in a conical percolator, and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4523. Tincture of Rhubarb and Senna. Reduce to a moderately coarse powder, 1 troy ounce rhubarb, 2 drachms senna, 2 drachms red saunders, 1 drachm each coriander and fennel, ½ drachm each saffron and liquorice, and 6 troy ounces raisins deprived of their seeds. Macerate for 14 days in 3 pints diluted alcohol, and filter through paper. (*U. S. Ph.*)

4524. Tincture of Bloodroot. Moisten 4 troy ounces bloodroot (sanguinaria), in moderately fine powder, with 1 fluid ounce diluted alcohol; pack it in a conical percolator, and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4525. Tincture of Serpentaria. Moisten 4 troy ounces serpentaria (Virginia snakeroot), in moderately fine powder, in 1 fluid ounce diluted alcohol. Pack it in a conical percolator, and gradually pour diluted alcohol upon it until 2 pints of tincture are obtained. (*U. S. Ph.*)

4526. Tincture of Valerian. This is obtained in the same manner as the tincture of serpentaria. (*See last formula.*) (*U. S. Ph.*)

4527. Camphorated Tincture of Opium. (Paregoric Elixir). This is a camphorated tincture of opium. Macerate 1 drachm each powdered opium and benzoic acid, 1 fluid drachm oil of anise, 2 ounces clarified honey, and 2 scruples camphor, in 2 pints diluted alcohol for 7 days, and filter through paper. (*U. S. Ph.*)

4528. Cummings' Quick Method of Making Paregoric. Take pulverized opium, 1 drachm; camphor gum, 2 scruples; benzoic acid, 1 drachm; oil of aniseed, 1 fluid drachm; clarified honey, 2 ounces; hot water and alcohol, 1 pint each. Dissolve the camphor and oil of aniseed in the alcohol; triturate the powdered opium in a mortar with some of the hot water for about 10 minutes, filter, and pass the remaining water through the dregs. To the fluid obtained add the alcoholic solution of oil and camphor, and dissolve finally the honey and benzoic acid in the mixture. By passing this once more through the pulverized opium, the latter will become perfectly exhausted. The addition of 10 grains of santal gives the preparation a beautiful rich tint.

4529. Tincture of Opium. (Laudanum). Macerate 2½ ounces opium, in moderately fine powder, in 1 pint water for 3 days, with frequent agitation. Add 1 pint alcohol, and macerate for 3 days longer. Percolate, and displace 2 pints tincture by adding dilute alcohol in the percolator. (*U. S. Ph.*)

4530. Ammoniated Tincture of Opium. Digest 6 drachms benzoic acid, 6 drachms hay saffron, 4 drachms sliced opium, and 1 drachm oil of aniseed, in 1 quart spirit of ammonia for a week, and filter. Stimulant, anti-spasmodic, and anodyne. Dose, 20 to 80 drops.

4531. Squibb's Compound Tincture of Opium. This mixture is composed of tincture of opium, tincture of capsicum, spirit of camphor, each 1 fluid ounce; purified chloroform, 3 fluid drachms; and a sufficient quantity of stronger alcohol to make the whole measure 5 fluid ounces. Each fluid drachm, or tea-spoonful, contains about 100 drops, consisting of 12 minims of each of the first three ingredients, and 4½ minims or 18 drops of chloroform. Dose, for persons over 18 years of age, a tea-spoonful; 2 to 6, ten to thirty drops; infants, one to ten drops, according to age. In time of epidemic cholera or diarrhea, when any person has two movements of the bowels more than natural within the twenty-four hours, the second one should be followed by a dose of this mixture; the dose to be repeated after every movement that follows. If the movements increase in frequency or in copiousness after the second dose of the medicine has been taken, a physician should be sent for at once, and a double dose be taken after each movement, until he arrives. Immediately after taking the first dose, the person should go to bed, and remain there for twelve hours after the diarrhea has entirely ceased.

4532. Compound Tincture of Pellitory. Take of bruised pellitory, 4 drachms; camphor, 3 drachms; oil of cloves, 2 drachms; powdered opium, 1 drachm; rectified spirit, 6 fluid ounces; digest for 8 days. The product is a most serviceable form of toothache-drops.

4533. Ethereo-alcoholic Tincture of Pellitory for Tooth and Face-ache. Take of bruised pellitory, 1 ounce; pure ether, 2 fluid ounces; strongest rectified spirit, 3 fluid ounces; digest them together in a stoppered bottle, in a cool place, for a week, with frequent agitation, then express the tincture, but avoid filtration. Some persons use equal parts of ether and spirit, but the product does not then keep so well. An excellent remedy for tooth-ache and face-ache, often giving almost immediate relief in the former case.

4534. Decoction of Balm of Gilead. For the decoction, simmer 1 ounce of the buds in a quart of soft water, down to half a pint. Take a wine-glassful or more, when the cough is troublesome.

4535. Tincture of Balm of Gilead. Infuse 2 ounces of the buds in a quart of good rum, and 4 ounces of sugar. Digest for 4 days. Take 2 or 3 tea-spoonfuls at a time. It greatly relieves cough, pains in the chest, and other pulmonary affections. The tincture and decoction form excellent remedies for cough, asthma, wheezing, &c.

4536. Tincture of Prickly-ash Berries. Macerate 8 ounces prickly-ash berries (Xanthoxylum) for 14 days in 2 pints diluted alcohol; or, displace 2 ounces of tincture by percolation. This tincture possesses all the virtues of the berries. In cholera, the dose is from ½ to 1 fluid ounce, repeated as often as required; in ordinary cases from 1 to 4 fluid drachms, given in water. (*Am. Dis.*)

4537. Tincture of Aloes. Take 1 troy ounce socotrine aloes in fine powder, and 3 troy ounces liquorice; macerate for 14 days in ½ pint alcohol and 1½ pints distilled water, and filter through paper. (*U. S. Ph.*)

4538. Tincture of Aloes and Myrrh. Take 3 troy ounces each socotrine aloes and myrrh, both in moderately fine powder; 1 troy ounce saffron in moderately coarse powder; mix together, moisten with 2 fluid ounces alcohol, pack it moderately in a conical percolator, and displace, with alcohol, 2 pints of the tincture. This tincture may also be prepared by maceration for 14 days with 2 pints alcohol, and filtering through paper. (*U. S. Ph.*)

4539. Tincture of Cantharides. Moisten 1 troy ounce cantharides, in fine powder, with ½ fluid ounce diluted alcohol; pack it in a conical percolator, and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4540. Tincture of Cardamom. Moisten 4 troy ounces cardamom, in fine powder, with 2 fluid ounces diluted alcohol; pack it firmly in a cylindrical percolator, and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4541. Tincture of Castor. Macerate 2 troy ounces bruised castor for 7 days in 2 pints alcohol; express, and filter through paper.

4542. Acetous Tincture of Valerian. Valerian root, bruised, 4 ounces; acetic acid, 1½ ounces; diluted alcohol, 1½ pints. Digest for 10 days in a closed vessel, and then filter. The tincture, as thus prepared, is of a beautiful red color with the predominating smell of the valerian—taste bitter and slightly astringent; may be given in doses of a dessert spoonful every 3 hours.

4543. Dover's Tincture. Pulverized ipecacuanha and opium, of each 8 grains; diluted alcohol, 1 fluid ounce. Macerate for 14 days and filter; or macerate 6 hours and displace 1 fluid ounce with diluted alcohol, 1 fluid drachm; equivalent to 10 grains Dover's powder. Used in combination with spirit of Mindererus effervescing draught, and other anti-febrile remedies in liquid form.

4544. Sweet Tincture of Red Bark (Cinchona). Red cinchona bark, in fine powder, 4 troy ounces; strong alcohol and syrup, sufficient quantity; dilute alcohol (alcohol 3 parts to 1 part water), 1½ fluid drachms. Moisten the cinchona with the dilute alcohol, and pack in a glass funnel, in the neck of which sufficient tow (free from tar) has been placed, to act as a filter; cover the surface with a piece of perforated paper, and pour on alcohol previously mixed with an equal volume of syrup until it has reached the tow and the surface of the powder is covered; cork the neck of the funnel and allow it to macerate 48 hours; then remove the cork and continue the percolation with equal parts of alcohol and syrup, mixed, until 16 fluid ounces have been obtained.

4545. Sweet Tincture of Rhubarb. Take of rhubarb, bruised, and liquorice root, bruised, of each 2 ounces; aniseed, bruised, and sugar, of each 1 ounce; diluted alcohol, 2 pints. Macerate for 14 days, express, and filter.

4546. Aqueous Tincture of Rhubarb: Take of alkaline fluid extract of rhubarb, 3 fluid ounces. (*See No.* 4591.) Neutral carbonate of potassa, 240 grains; cinnamon water, 4 troy ounces; dissolve the carbonate in the cinnamon water; add the fluid extract, and then sufficient water to make the whole weight 14 troy ounces. The above is an improvement on the preparation in the Prussian Ph., but are in officinal proportions, and yield a strictly officinal result.

4547. Tincture of Catechu. Take 3 troy ounces catechu, and 2 troy ounces cinnamon, both in moderately coarse powder. Mix, and moisten with 1 fluid ounce diluted alcohol; pack it into a conical glass percolator, and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4548. Tincture of Cinnamon. Mix 2 measures alcohol with 1 of water; moisten 3 troy ounces finely powdered cinnamon with 1 fluid ounce of the mixture; pack it in a conical percolator, and displace with the mixture 2 pints of tincture. (*U. S. Ph.*)

4549. Tincture of Colchicum. Moisten 4 troy ounces colchicum seed, in moderately fine powder, with 1 fluid ounce diluted alcohol; pack it in a cylindrical percolator, and displace, with diluted alcohol, 2 pints of the tincture. (*U. S. Ph.*)

4550. Tincture of Columbo. moisten 4 troy ounces columbo, in moderately one powder, and percolate 2 pints tincture in the same manner as the colchicum in last formula. (*U. S. Ph.*)

4551. Tincture of Cubeb. Percolate 2 pints tincture from 4 troy ounces cubeb, following the formula laid down for colchicum. (*See No.* 4549.) (*U. S. Ph.*)

4552. Tincture of Tar. Macerate 2 ounces tar in 16 ounces alcohol, until dissolved.

4553. Hamilton's Tincture of Dog-Wood. Bark of dogwood, 1 ounce; rectified spirit, 12 fluid ounces; mix, macerate for 14 days, and filter.

4554. Tincture of Colocynth. Colocynth, 8 parts; star anise, 1 part; alcohol, 96 parts. Macerate for 3 days, and filter. Dose, 15 to 20 drops.

4555. Compound Tincture of Squills and Benzoin. This is also known as *Wedel's Elixir*. Take of squills, orris root, and elecampane, each 25 drachms; liquorice root, 2 drachms; aniseed and myrrh, of each 4 scruples; saffron, 18 grains; dilute alcohol, 22 fluid ounces. Macerate for 15 days, express and filter. Dose, 40 to 60 drops, in catarrh, asthma, &c.

4556. Wood's Tincture of Kino. Kino in fine powder, 1½ ounces; alcohol (.835), 8 fluid ounces; water, 4 fluid ounces; glycerine, 4 fluid ounces. Mix the alcohol, water, and glycerine together, and, having mixed the kino with an equal bulk of clean sand, introduce in a percolator and pour on the menstruum. This menstruum seems to thoroughly exhaust the drug of its astringent principle, and also makes a nice-looking preparation that will not deteriorate by exposure.

4557. Compound Tincture of Kino. This is made in the same way as other tinctures (*see No.* 35), with the following ingredients: 1 drachm each powdered opium, kino, and cochineal; 1½ drachms each camphor and cloves; 1 fluid ounce aromatic spirit of ammonia, and 1 pint alcohol.

4558. Tincture of Ginger. Moisten 8 troy ounces ginger, in fine powder, with 2 fluid ounces alcohol; pack it firmly in a cylindrical percolator, and displace, with alcohol, 2 pints of tincture. (*U. S. Ph.*)

4559. Tincture of Jalap. Mix 2 measures alcohol with 1 water; moisten 6 troy ounces jalap, in fine powder, with 2 fluid ounces of the mixture; pack it moderately in a cylindrical percolator, and displace with the mixture 2 pints of tincture. (*U. S. Ph.*)

4560. Tincture of Myrrh. Take 3 troy ounces myrrh in moderately coarse powder; press it moderately into a conical percolator, and displace with alcohol 2 pints of tincture. (*U. S. Ph.*)

4561. Tincture of Nutgall. Moisten 4 troy ounces nutgall, in moderately fine powder, with 1 fluid ounce diluted alcohol; pack it in a glass percolator, and displace, with diluted alcohol, 2 pints tincture. (*U. S. Ph.*)

4562. Tincture of Quassia. Moisten 2 troy ounces quassia, in moderately fine powder, with 1 fluid ounce diluted alcohol; pack it in a percolator and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4563. Tincture of Rhatany. Moisten 6 troy ounces rhatany, in moderately fine powder, with 2 fluid ounces diluted alcohol; pack it in a cylindrical glass percolator, and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4564. Tincture of Squill. Moisten 4 troy ounces squill, in moderately coarse powder, with 1 fluid ounce diluted alcohol; pack it in a conical percolator, and displace, with diluted alcohol, 2 pints tincture. (*U. S. Ph.*)

4565. Tincture of Stramonium. Take 4 troy ounces stramonium seed, in moderately fine powder, and percolate 2 pints of tincture in the same manner as the squill in the last formula. (*U. S. Ph.*)

4566. Tincture of Tolu. Macerate 3 troy ounces balsam of tolu in 2 pints alcohol until it is dissolved; then filter. (*U. S. Ph.*)

4567. Compound Tincture of Benzoin. Macerate 3 troy ounces benzoin, ½ troy ounce socotrine aloes, both in coarse powder, and 2 troy ounces storax, for 14 days in 2 pints alcohol; filter through paper. (*U. S. Ph.*)

4568. Compound Tincture of Cardamom. Take 6 drachms cardamom, 2 drachms caraway, 5 drachms cinnamon, 1 drachm cochineal, all in moderately fine powder; mix together, and moisten with ½ fluid ounce diluted alcohol; pack it in a cylindrical percolator, and displace, with diluted alcohol, 6 fluid ounces of tincture. Lastly mix this with 2 troy ounces clarified honey, and filter through paper. (*U. S. Ph.*)

4569. Compound Tincture of Gentian. Mix together 2 troy ounces gentian, 1 troy ounce bitter orange peel, ½ troy ounce cardamom, all in fine powder; moisten with 1½ fluid ounces diluted alcohol; pack it in a conical percolator, and displace, with diluted alcohol, 2 pints of tincture. (*U. S. Ph.*)

4570. Compound Tincture of Iodine. Dissolve ½ troy ounce iodine and 1 of iodide of potassium in 1 pint alcohol. (*U. S. Ph.*)

Fluid Extracts. This form of medicinal extracts was introduced into the United States Pharmacopœia in 1850, for the first time as a distinct class of preparations. Their distinctive character is the concentration of the active ingredients of a substance into a small bulk and in liquid form. Their advantages consist in greater convenience of administration, and in the fact that, not having been subjected to excessive evaporation, the active principles they contain are less liable to have suffered injury by heat. The main difficulty lies in their liquid form increasing the liability to undergo spontaneous decomposition; this is counteracted in some cases by the addition of sugar, in others by alcohol, and in others again by a mixture of both. Some fluid extracts have a tendency to deposit matter when combined with sugar, rendering the extract turbid or cloudy in appearance; instead of sugar, Mr. Alfred B. Taylor has proposed the use of glycerine, which, while it has the same preservative influence, possesses the property of dissolving the matter which would be deposited by the use of sugar. Fluid extracts are obtained by percolation, and the menstruum used is alcohol or alcohol and water, the proportions of each depending on the nature of the substance to be extracted. The price of alcohol has greatly increased since 1860, and a regard to economy has probably, in some cases, induced deviations in officinal preparations. This point will probably receive due consideration at the next revision of the Pharmacopœia.

4572. Grahame's Method of Percolation. Professor Grahame, of the Maryland College of Pharmacy, has proposed a modification of the displacement process which may be thus stated: Reduce the substance, by contusion, to a powder which will pass through a sieve of 40 meshes to the linear inch (if of close texture a sieve of 60 meshes is to be preferred); now add just sufficient of the menstruum to dampen the powder without wholly destroying its mobility; this usually requires about one-fourth as much menstruum as of the powder. Transfer to a glass funnel with a plug of cotton in the neck, and pack it with little or much pressure, according to its tenacity or disposition to adhere (more firmly when alcohol or ether is the menstruum than when water is to be used); if the particles of the moistened powder move freely on each other, the packing should be with as much force as a glass vessel will bear, the whole of the powder being introduced at once, and packed with a pestle or packing-stick. The whole quantity of the menstruum may now be poured on, or to the capacity of the funnel, and the process allowed to proceed to completion, without in any case repassing the first portions of the liquid. By this process, if carefully followed, very concentrated solutions are obtained. Indeed, most of the fluid extracts may be completed with little or no evaporation.

4573. Procter's Classified Formula for Making Fluid Extracts. In order to obtain as great a uniformity in the preparation of fluid extracts as the nature of the various drugs would permit, the following practical classification was drawn up by Professor William Procter, Jr., and submitted to the American Pharmaceutical Association, by whom the matter had been entrusted to him for investigation. In order to economize space, we give it in a somewhat condensed form. The paramount object in obtaining the fluid extract of a drug, is to extract, as far as possible, all the valuable ingredients; to condense them to some uniform standard strength, so that, for instance, each fluid ounce of the extract should contain the virtues of, and represent 1 ounce of the drug; and to leave the fluid in the best possible condition for retaining in solution the active principles of the drug. The process of percolation is adopted, as best adapted to effect the desired objects, and admitting a greater degree of accuracy than that of maceration. Glass funnels answer a good purpose, but cylindrical percolators may be employed. In either case, if the powder has been properly compacted, the menstruum, when added, passes very deliberately, by drops, and it will be found that the proportion of the percolate which is directed to be reserved will contain nearly all of the most valuable parts of the drug. In this way the action of the heat and air is entirely prevented on the most important part of the extracted matter, and where volatile oils are concerned this fact is particularly important. The ingredients are first reduced to a powder; and, in order to ensure the required result, different degrees of fineness are recommended, suitable to the degree of solubility and other natural peculiarities of the various drugs employed. This end is attained by sifting the powder through sieves containing a certain number of meshes to the linear inch. A sieve of 40 meshes to the inch will produce a powder designated as No. 40, &c.

A new class of oleo-resinous fluid extracts has been suggested, in which the stronger aromatics have been introduced, such as cloves, cinnamon, cardamom, &c., and which possess, for certain uses, very desirable advantages from their concentration. The number of oleo-resins has been considerably increased, on the ground that they represent their respective sources more completely and in smaller bulks than in any other form of fluid or semi-fluid extracts. On account of their superior strength, they should occupy a distinct position under the name of "*Oleo-resins,*" to distinguish them more particularly from all those preparations which go by the name of fluid extracts.

4574. Class No. 1, of Classified Fluid Extracts. The following substances are to be reduced to a powder of No. 60 degree of fineness; with the exception of *Buchu,* which should be in No. 40 powder.

Aconite Leaves.
Belladonna Leaves.
Buchu.
Digitalis (Fox glove).
Henbane Leaves.
Matico.
Thorn-Apple (Stramonium).
Valerian.

The menstruum employed is 2 pints alcohol diluted with 1 pint water. Moisten 16 troy ounces of the powdered drug evenly with 4 fluid ounces of the diluted alcohol; pack it firmly in a percolator, cover the surface of the powder with a disc of cloth (muslin, linen, lint, or any insoluble porous tissue, to prevent the disturbance of the powder); then pour on the menstruum gradually, so as to displace 3 pints; reserve the first 12 fluid ounces, and evaporate the remainder on a water-bath at 150° Fahr., to 4 fluid ounces; mix this with the reserved tincture; and, after standing 24 hours, filter through paper. The alcoholic strength of these extracts is nearly 50 per cent.

4575. Class No. 2, of Classified Fluid Extracts. The drugs included under this class should also be in at least No. 60 powder. Ipecacuanha and jalap may be reduced to dust with advantage. The fluid to be used is alcohol having a specific gravity of .835.

Aconite Root.
Black Snakeroot (Cimicifuga, or Black Cohosh).
Black Hellebore.
Ipecacuanha.
Jalap.
May-apple Root (Podophyllum or Mandrake).
Blood Root (Sanguinaria).
American Hellebore (Veratrum viride).

Moisten 16 troy ounces of the drug with 6 fluid ounces of the alcohol; displace 3 pints as directed in class 1, reserving the first ½ pint of percolate; distill the remainder until reduced to ½ pint, and, while hot, mix the distillate with the reserved tincture. After standing 24 hours, filter through paper.

4576. Class No. 3, of Classified Fluid Extracts. The substances included under this class require to be used in No. 50 powder; except columbo, No. 40; and squill, on account of its gummy nature, No. 30. The extract of colchicum deposits, by standing, a whitish sediment, which is believed to be in no wise connected with the activity of the preparation; it is recommended to allow this deposit to form before proceeding to filtration. Dilute alcohol is employed for making these extracts.

Colchicum Root.
Columbo.
Chiretta.
Boneset (Eupatorium).
Gentian.
Squill (Scilla).
Seneka.
Virginia Snake Root (Serpentaria).

Moisten 16 troy ounces of the substance with 4 fluid ounces dilute alcohol, percolate 3 pints, as in class 1, reserving the first 12 fluid ounces, evaporate the remainder to 4 fluid ounces by a water-bath at 150° Fahr.; mix with the reserved tincture; and, after 24 hours, filter.

4577. Class No. 4, of Classified Fluid Extracts. This class consists of *saccharine fluid extracts,* the sugar being introduced as a preservative agent. A decided advantage is gained by adding the sugar to the extract before the completion of the evaporation; in some cases it might be better to add the sugar previous to any evaporation. The fluid extracts of pipsissewa, bittersweet, pomegranate, pink-root, and sarsaparilla, fully represent the several drugs; and, combined with 3 times their bulk of simple syrup, afford syrups of the ordinary strength. The menstruum used in these preparations is dilute alcohol; and the drugs are to be reduced to No. 50 powder, except galls, which should be No. 40.

Yellow Peruvian Bark (Cinchona Calisaya).
Pipsissewa (Chimaphila).
Bittersweet (Dulcamara).
Galls.
Cranesbill (Geranium).
Pomegranate-root Bark (Granatum).
Blackberry Root (Rubus).
Sarsaparilla.
Pink Root (Spigelia).
Bearberry Leaves (Uva Ursi).

Moisten 16 troy ounces of the powdered drug with ½ pint dilute alcohol; let it stand 30 minutes, then percolate as directed for class 1, until 3 pints have passed through; evaporate at a moderate heat on a water-bath to 1 pint; add 10 ounces sugar, evaporate to 1 pint, and strain while hot.

4578. Class No. 5, of Classified Fluid Extracts. The extracts obtained by this process are termed *acetic fluid extracts.* The acetic acid is introduced to control the tendency to decomposition, caused by the existence, in the drugs treated in this manner, of a salt consisting of an alkaloid and an organic acid. The fluid used is a mixture of ½ fluid ounce acetic acid and 3 pints diluted alcohol; and the drugs should be reduced to a No. 60 powder.

Ergot. Lobelia Leaves. Hemlock (Conium).

Moisten 16 troy ounces of the powder with ½ pint of the acetic mixture; pack it in a conical percolator, and displace 3 pints, reserving the first 12 fluid ounces, using dilute alcohol during the last part of the percolation. Evaporate the latter percolate to 4 fluid ounces, at a temperature not exceeding 150° Fahr.; mix this with the reserved tincture, and filter through paper.

4579. Class No. 6, of Classified Fluid Extracts. Under this division are placed *oleoresinous fluid extracts.* (*See No.* 4573.) The menstruum employed is deodorized alcohol, and the drugs are used in No. 50 powder; except canella, Ceylon cinnamon, elecampane, and orris root, used in No. 60, and myrrh in No. 30 powder.

Capsicum.
Canella.
Cardamom.
Cloves (Caryophyllum).
Ceylon Cinnamon.
Cubebs.
Elecampane (Inula).
Lupulin.
Orris Root, (Iris Florentina).
Myrrh.
Pellitory Root (Pyrethrum).
Allspice (Pimento).
Prickly Ash Bark (Xanthoxylum).

The oleoresin of the above substances are to be obtained by percolation, and distilling off the alcohol.

This process of obtaining the oleoresins was modified before adoption in the U. S. Ph., by substituting ether for deodorized alcohol as the menstruum employed. The five following oleoresins are officinal preparations.

4580. Oleoresin of Capsicum. Take 12 troy ounces capsicum in fine powder, press it firmly in a cylindrical percolator, and gradually pour ether on it sufficient to displace 24 fluid ounces. Recover from this, by distillation on a water-bath, 18 fluid ounces of ether, and expose the residue in a capsule until the remaining ether has evaporated; lastly, remove, by straining, the fatty matter which separates on standing, and keep the oleoresin in a well stopped bottle. (*U. S. Ph*).

4581. Oleoresin of Cubebs. Moderately press 12 troy ounces cubebs in fine powder into a cylindrical percolator, and treat by the same process as the capsicum in the last formula. (*U. S. Ph*).

4582. Oleoresin of Lupulin. Press 12 troy ounces lupulin into a narrow cylindrical percolator, and displace with ether 30 fluid ounces; complete the process by distillation and subsequent evaporation in the same way as for capsicum. (*See No.* 4580.) (*U. S. Ph*).

4583. Oleoresin of Black Pepper. Treat 12 troy ounces black pepper in fine powder, by ethereal percolation and distillation, in the same manner as laid down in No. 4580; expose the residue after distillation in a capsule, until the remaining ether has evaporated and the deposition of piperin in crystals has ceased. Lastly, separate the oleoresin from the piperin by expression through a muslin strainer, and keep in a well-stopped bottle. (*U. S. Ph*).

4584. Oleoresin of Ginger. Take 12 troy ounces ginger in fine powder, press it firmly into a cylindrical percolator, and pour upon it 12 fluid ounces stronger ether; continue the percolation with alcohol sufficient to displace 12 fluid ounces in all. Recover from this, by distillation on a water-bath, 9 fluid ounces ether, and expose the residue in a capsule until the volatile part has evaporated. Lastly, keep the oleoresin in a well-stoppered bottle. (*U. S. Ph.*)

4585. Oleoresin of Male Fern. Pack closely 2 pounds avoirdupois, male fern, in coarse powder in a percolator; displace with 4 imperial pints ether, or until it passes colorless. Let the ether evaporate on a water-bath, or recover it by distillation, and preserve the oily extract. (*Br. Ph.*) This preparation by its character decidedly belongs to the oleoresins; it has long been known and much used in Europe, under the name of *oil of fern*, in the treatment of the tapeworm. It is believed to have all the vermifugal powers of the male fern, and may be given in ½ fluid drachm doses. (*U. S. Dis.*)

4586. Fluid Extract of Rhubarb and Potassa. Grind or coarsely bruise 2 pounds avoirdupois best India rhubarb, 1 pound cassia or cinnamon, and 1 pound golden seal; macerate for 24 hours or more in 1 gallon good French brandy; express strongly, and add 1 fluid drachm oil of peppermint previously dissolved in a little 90 per cent. alcohol. Break up the compressed residue, and percolate with warm water until exhausted. Evaporate this solution to 4 pints, and, while warm (not too hot), dissolve in it 2 pounds bicarbonate of potassa, and 3 pounds refined sugar; evaporate, if necessary, to the quantity that the first macerated tincture lacks of 1½ gallons. Lastly mix the two together. It is used for the same purposes as the compound powder of rhubarb, 2 fluid drachms of the extract being equivalent to 1 drachm of the powder. (*Am. Dis.*) A simple alkaline extract of rhubarb is given in No. 4591.

4587. Fluid Extract of Stillingia. Cut fresh root of stillingia, 16 troy ounces, into small pieces; cover with alcohol, and digest for 24 hours. Then transfer to a percolator, and pack it so as to run slowly; add alcohol gradually, returning the first that passes until it runs clear. Reserve the first 12 fluid ounces percolated; then continue the percolation, with diluted alcohol, until the residuum is nearly exhausted; add 8 ounces white sugar to this dilute percolate, and evaporate by moderate heat to 4 fluid ounces. Add to this the reserved tincture, and 1 fluid drachm oil of caraway, and make 1 pint fluid extract. The dose is from 2 to 5 drops.

4588. Fluid Extract of Yarrow. Take of yarrow (the recently dried herb) in coarse powder, 8 ounces; dilute alcohol (2 parts 95 per cent. alcohol and 1 part water), a sufficient quantity. Pour over the powdered herb 4 ounces of the diluted alcohol, and work through with the hands until thoroughly moistened; allow it to stand in a covered jar for 24 hours. Pack closely in a funnel or other displacer and proceed to displace until 24 fluid ounces are obtained, which, if performed with proper care, will exhaust the herb, as tested, by tasting the droppings. The resulting liquid should be exposed in a shallow dish (in summer to a draught of air under an open window, in winter on a shelf near the top of the room), and allowed to evaporate spontaneously until it measures 16 fluid ounces; 30 or 40 grains bicarbonate of potassa in powder may then be added, which retains the extractive in solution, and clears the liquid without interfering with its properties. The evaporation of this fluid extract may be continued. if desired, with a very gentle heat (in a water-bath) until reduced to the consistence of an ordinary extract. The result in either case, fluid or solid, possesses in a marked degree the sensible and other properties of the herb, each tea-spoonful representing 30 grains of the herb.

4589. Procter's Fluid Extract of Wild Cherry Bark. Take of wild cherry bark, 24 ounces; sweet almonds, 3 ounces; and pure granulated sugar, 36 ounces. Macerate the powdered bark in 2 pints of 88 per cent. alcohol for 8 hours, introduce it into a percolator, and pour alcohol on it until 5 pints have passed, observing to regulate the passage of the liquid by a cork or stop-cock. Introduce the tincture into a capsule (or still, if the alcohol is to be regained), and evaporate it to a syrupy consistence; add ½ pint water, and again evaporate until all the alcohol is removed. Beat the almonds, without bleaching. into a smooth paste with a little of the water, and then sufficient to make the emulsion measure 1½ pints, and pour it into a quart bottle, previously containing the solution of the extract of bark; cork it securely and agitate occasionally for 24 hours, so as to give time for the decomposition of the amygdaline. The mixture is then to be quickly expressed and filtered into a bottle containing the sugar. Water should be added to the dregs and they again expressed till sufficient liquor is obtained to make the fluid extract measure 3 pints. The proportion of sugar, though less than that in syrup, is sufficient to preserve the preparation, aided by the presence of hydrocyanic acid.

4590. Parrish's Compound Fluid Extract of Buchu. Take of buchu, in coarse powder, 12 ounces; alcohol, 3 pints; water, 6 pints, or sufficient. Treat the leaves by maceration and displacement, first with a portion of the alcohol, and then with the remainder mixed with the water; evaporate the resulting liquid with a gentle heat to 3 pints, and add 2½ pounds sugar. Continue the heat till it is dissolved, and, after removing from the fire, add oil of cubebs, oil of juniper, of each 1 fluid drachm; spirit of nitric ether, 12 fluid ounces, previously mixed. Stir together.

4591. Alkaline Fluid Extract of Rhubarb. Take of fluid extract of rhubarb (by repercolation), 1 fluid ounce; neutral carbonate of potassa, 80 grains; water, 1 fluid ounce. Dissolve the carbonate in the water; to this add the fluid extract, and let the mixture repose 6 to 12 hours; then strain through muslin, and filter, if desirable. The alkaline fluid extract of rhubarb can be mixed with water in any proportion, affording a perfectly clear and transparent liquid of a deep red color. Another alkaline fluid extract of rhubarb will be found in No. 4586.

4592. Moore's Fluid Extract of Cimicifuga Racemosa (Black Cohosh or Black Snakeroot.) Take of cimicifuga, in No. 50 powder, 16 ounces, troy; alcohol 95 per cent., diluted alcohol, of each a sufficient quantity. Moisten the root with the alcohol, pack closely in the displacer, and pour on alcohol gradually until 8 fluid ounces have passed through, which reserve in a covered vessel to prevent evaporation, then proceed with dilute alcohol until the root is thoroughly exhausted. Evaporate over a water-bath until all the alcohol is driven off; set it aside to cool, that the resinous portion extracted may be deposited, which separate and add to the alcoholic portion first obtained; then proceed with the evaporation until reduced to 8 fluid ounces, and mix the two products; allow it to stand 48 hours, and then filter. (*See No.* 4575.)

4593. Compound Fluid Extract of Squills. This is alcoholic, in which 3 parts alcohol are diluted with 1 part water. Take of squills and seneka, each 16 ounces troy, reduced to a moderately coarse powder. Moisten with about 12 ounces of the liquid, and pack firmly in a conical percolator; cover the surface with a cloth and pour on of the same menstruum until 6 pints have slowly passed, reserving carefully the first 24 ounces. Evaporate the remainder in a water-bath at 150° Fahr., until reduced to 8 fluid ounces. Mix it with the reserved tincture, and, after standing, with occasional agitation, for 24 hours, filter, dropping sufficient of the menstruum on the filter to make the whole measure 2 pints. *Hive Syrup* may now be prepared from this extract by taking: compound fluid extract of squills, 4 fluid ounces; tartar emetic, 24 grains; simple syrup, 20 fluid ounces; hot water, ½ fluid ounce. Dissolve the tartar emetic in the water, and mix with the other ingredients.

4594. Procter's Fluid Extract of Hops. Take hops in coarse powder, 16 troy ounces. Mix in 4 ounces dilute alcohol; pack it in a conical percolator, cover the surface with cloth, and add dilute alcohol until 3 pints of tincture have slowly passed, carefully reserving the first 12 ounces. Evaporate the remainder of the tincture in a water-bath still to 4 fluid ounces, mix it with the reserved tincture, agitate occasionally during 24 hours, and filter, dropping sufficient dilute alcohol on the filter to make the measure of a pint.

4595. Procter's Fluid Extract of Liquorice. Take of Calabria liquorice, 8 troy ounces; and sugar in coarse powder, 10 troy ounces. Bruise the liquorice till it is reduced to pieces the size of a pea, enclose it in a gauze cloth, suspend it in a pint vessel, cover it with cold water, let it stand 12 hours (if in summer in a cool place), pour off the dense solution, renew the water, and again macerate and decant. Mix the two liquids, evaporate to 12 fluid ounces, dissolve in it the sugar, and again evaporate until the measure of 1 pint is obtained.

4596. Grahame's Fluid Extract of Burdock. Take of burdock, in No. 50 powder, 16 ounces; dilute alcohol (alcohol 9 parts, water 7 parts), a sufficient quantity. Dampen the powder with the menstruum and pack it in a suitable glass displacer; having covered the surface with a piece of muslin or perforated paper, pour on the menstruum, and continue the percolation to exhaustion, reserving 1½ ounces of the first runnings, evaporate the remainder over a water-bath until reduced to 9 fluid ounces, to which add 4 ounces sugar and dissolve. Strain, if necessary, and add the reserved portion. The dose of the extract is one tea-spoonful, representing 80 grains of the root. Burdock is one of the best vegetable alteratives, or blood depurents, and it is believed that this fluid extract might be advantageously substituted for that of sarsaparilla, as a more efficient and reliable alterative, or at least as a valuable addition to it.

4597. Fluid Extract of Chamomile. Take of fresh chamomile flowers, 1 pound; alcohol of specific gravity .871. Moisten the chamomile in coarse powder, with the alcohol, then pack in a percolator, and cover with the alcohol; digest 6 days, and draw off 12 ounces, which set aside. Continue the displacement with diluted alcohol, until it is freely exhausted of its bitterness, which evaporate in a vacuum to 4 fluid ounces. Mix and fiter. 1 drachm of this preparation represents 60 grains of chamomile flowers, which is usually given in doses of 20 grains, as a tonic, to 1 drachm, as an antiperiodic—making the dose for like cases from 20 minims to 1 fluid drachm.

4598. Fluid Extract of Seneka. The formula for making this extract will be found in No. 4576, but seneka yields its active principles so easily and entirely, that an extract of it may be obtained of standard strength without evaporation. If a convenient quantity of seneka in No. 50 powder be divided into 3 equal parts, and repercolated with 85 per cent. alcohol, an extract will be obtained, each fluid ounce of which will represent a troy ounce of the root.

4599. Fluid Extract of Ipecacuanha. Moisten 16 troy ounces ipecacuanha in fine powder with 6 fluid ounces alcohol; press it firmly into a conical percolator, and displace 3 pints of tincture, or until the ipecacuanha is exhausted. Distill the tincture over a water-bath until the residue is of a syrupy consistence. Mix with 1 fluid ounce acetic acid and 10 fluid ounces water; boil until reduced to ½ pint, and the resinous matter has separated. Filter when cold, and add water through the filter to make the filtrate up to ½ pint. Mix with ½ pint alcohol. (*U. S. Ph.*)

It is affirmed that syrup made from extract prepared according to the above formula is apt to become cloudy. It is proposed to avoid this result by dividing ipecacuanha in No. 50 powder into 3 parts, and obtaining the extract by repercolation in the same manner as the seneka in No. 4598.

4600. Fluid Extract of Sumach. Take 4 pints 76 per cent. alcohol, and 1 pound of the recently dried bark of Rhus Glabrum (sumach) in coarse powder. Moisten the powdered bark with sufficient alcohol and let it macerate for 24 hours, then percolate with the remainder of the alcohol, returning the first that passes until it runs clear. Reserve the first 4 clear fluid ounces of tincture, evaporate the remainder to 4 fluid ounces, and set aside. Then percolate the residuum nearly to exhaustion with hot water, evaporate this aqueous solution to ½ pint, then add to it 4 ounces white sugar, evaporate to 8 fluid ounces, and, while warm, mix it with the reserved 8 ounces of tincture to make 1 pint of fluid extract. (*Am. Dis.*)

4601. Fluid Extract of Scullcap. This is prepared from 1 pound of the dried leaves of scullcap (scutellaria) in precisely the same manner as directed for fluid extract of sumach in preceding receipt. (*Am. Dis.*)

4602. Fluid Extract of Life-Root is obtained from 1 pound recently dried life-root (senecio aureus) in the same manner as the sumach in No. 4600. (*Am. Dis.*)

4603. Fluid Extract of Senna and Jalap. Take 6 pints 76 per cent. alcohol. Mix together 1 pound senna and ½ pound jalap root, both in coarse powder; moisten them with some of the alcohol, and macerate for 24 hours. Transfer to a percolator and displace with the remainder of the alcohol; reserve the first 6 fluid ounces; evaporate the remainder to 6 fluid ounces and set also aside. Nearly exhaust the residuum with diluted alcohol and evaporate it to 12 fluid ounces; add 8 ounces white sugar; again evaporate to 12 fluid ounces, and, while warm, add 6 drachms carbonate of potassa, 40 minims oil of cloves dissolved in 1½ fluid drachms Hoffman's anodyne, and the 12 ounces reserved extract, making altogether 1½ pints fluid extract. (*Am. Dis.*)

4604. Fluid Extract of Blessed Thistle. Take 16 troy ounces blessed thistle (carduus benedictus) in No. 40 powder, dampen it with about 6 ounces dilute alcohol, and pack it in a suitable glass percolator; having covered the surface with a piece of muslin or a layer of clean sand (which is more convenient), displace with dilute alcohol. When 1 pint of liquid shall have passed, put it aside in a warm place for spontaneous evaporation until reduced to 10 fluid ounces. Continue the percolation with diluted alcohol until 2 more pints of liquid have passed; to these add 6 ounces sugar and reduce by evaporation over a water-bath to 6 fluid ounces, adding, while still hot, the 10 ounces of concentrated tincture; on cooling, the mixture becomes slightly turbid, but by the addition of a few drops of alcohol the resinous matter is redissolved, making a dark brown fluid extract which may be filtered if necessary.

4605. Fluid Extract of Cinchona. Take cinchona (calisaya) in powder, 8 troy ounces; simple (officinal) syrup, 4 fluid ounces; glycerine, 4 fluid ounces; alcohol, concentrated and diluted, a sufficient quantity. Moisten the cinchona with 6 fluid ounces of diluted alcohol; allow it to stand in a covered jar for three hours, and then transfer it to a cylindrical percolator. Pack it firmly, and gradually pour upon it diluted alcohol, until 12 fluid ounces of the tincture have been obtained. Set this aside, and continue the percolation with dilute alcohol, until the cinchona is thoroughly exhausted. To the last percolate add the syrup and glycerine, and evaporate by means of a water-bath to about 10 fluid ounces. To this add the reserve tincture, and continue the evaporation to 14 fluid ounces. Remove from the water-bath, and, when nearly cold, add sufficient alcohol to make the whole measure 16 fluid ounces. Each pint of the fluid extract contains nearly 2½ ounces of alcohol. (*See No.* 4577.)

4606. Fluid Extract of Pareira. Digest for 24 hours 1 pound pareira root, in coarse powder, in 1 pint boiling distilled water; then pack it in a percolator, and displace 1 gallon, or until the pareira root is exhausted. Evaporate over a water-bath to 13 fluid ounces; when cold add 3 fluid ounces rectified spirit, and filter through paper. This is the officinal formula of the British Pharmacopœia, consequently avoirdupois weight and imperial measure are to be used in preparing it. The dose consists of 1 to 2 fluid drachms.

4607. Moore's Fluid Extract of Vanilla. Take 8 troy ounces vanilla, and an equal weight of crushed loaf sugar. Slit the pods from end to end with a knife; then take them in small bundles, held tightly between the fingers, and cut them transversely into very small pieces. Of these, beat small portions at a time in an iron mortar, with a little of the sugar, until reduced to a damp powder, which must be rubbed with the hand through a No. 20 sieve; any coarse particles which will not pass through the sieve must be returned to the mortar, and, with fresh portions of vanilla and sugar, again treated as before. This is to be continued until the whole is reduced to a No. 20 powder. This is then to be mixed with 5 pints of a mixture of 3 parts alcohol and 1 part water, and the whole introduced into a 1-gallon stone jug, which must be tightly corked. The jug is then placed in a water-bath, resting upon folds of paper, and the mixture digested for 2 hours at a temperature of from 160° to 170° Fahr. The upper part of the jug must be kept cool (to prevent the undue expansion of vapor), by wrapping around it a towel or other cloth kept saturated by having cold water squeezed upon it from a sponge every 15 or 20 minutes. The jug should also be removed from the bath after each application of the water, and its contents well shaken, keeping the hand upon the cork to prevent its expulsion, and perhaps consequent loss of material. When the digestion has been completed, and the mixture has cooled, it is to be expressed through muslin. Pack the residue, previously rubbed with the hands to a uniform condition, firmly in a glass funnel prepared for percolation, and gradually pour upon it first the expressed liquid, and when this has all disappeared from the surface, continue the percolation with a mixture of 3 parts alcohol and 1 part water, until 8 pints of percolate are obtained.

Medicinal Essences.

The usual rule for making essences, is to mix 1 ounce of the essential oil with 1 quart of alcohol; although much is sold that contains only ½ ounce, and even ¼ ounce of the oil to the quart. A strong essence would consist of 1 ounce of oil to 1 pint of alcohol; from 10 to 30 drops of this would make a dose.

4609. To Color Medicinal Essences. Essence of peppermint is generally colored with tincture of turmeric; essence of cinnamon with tincture of red sandal wood; wintergreen with tincture of kino. The best way of coloring an essence is to steep for 12 hours the green leaf or other substance from which the oil is made, and then filter. The coloring is merely a matter of appearance; the essences are just as good without it.

4610. Essence of Peppermint. Oil of peppermint, 1 ounce; herb peppermint, ½ ounce; spirit of wine, 1 pint. Digest for a week, or until sufficiently colored. Palish-green, and very strong of the peppermint. Essence of peppermint is not conceived to be good by the ignorant unless it has a pale tint of green, which they presume is a proof of its being genuine. The most harmless way is to steep a little of the green peppermint in the spirit for this purpose (as above), or if this is not at hand, a little parsley will do equally as well, and in fact improve the flavor.

4611. Essence of Camphor, also called Liquor of Camphor; Concentrated Tincture of Camphor; Camphor-Drops. Dissolve 4½ drachms (avoirdupois) clear camphor, in 1 imperial pint rectified spirit. This forms the ordinary essence of camphor and the best *spirit of camphor* of the stores. Added to 15 times its bulk of pure cold water, it forms (by agitation) a transparent solution exactly resembling the camphor-julep, camphor-water, or camphor-mixture used in medicine, and which, either alone or with a little more water, forms an excellent wash for the teeth and mouth, as noticed elsewhere. (*See No.* 1335.)

Dissolve 1 avoirdupois ounce camphor in 10 ounces rectified spirit. This forms the *Concentrated Essence of Camphor* of the druggists. 10 or 12 drops added to 1 fluid ounce of pure cold water form the transparent *camphor-julep* or *camphor-water* before noticed.

4612. Essence of Coltsfoot. Balsam of tolu, 1 ounce; compound tincture of benzoin and rectified spirit of wine, of each 2 ounces; dissolve.

4613. Essence of Chamomile. Essential oil of chamomile, ½ ounce to 1 ounce; spirit of wine, 1 pint; mix. White. Or: Gentian root, sliced or bruised, 1 pound; dried orange peel, ¼ pound; spirit of wine, 1 gallon; essential oil of chamomile, 5 ounces; macerate a week. Slightly colored. Some persons use ½ pound of quassia wood, instead of the gentian and orange peel. Both the above are stomachic and tonic.

4614. Essence of Spearmint. 1 ounce of essential oil to 1 pint of spirit of wine tinged green. Process, use, and dose, the same as essence of peppermint. (*See No.* 4610.)

4615. Bitter Essence. Wormwood, 4 parts; gentian root, bitter orange peel, and blessed thistle, of each 1 part; alcohol, 45 parts; digest for a week. Dose, ½ drachm to 2 drachms, combined with mixtures. Tonic and stomachic.

4616. Essence of Beef. Chop fine 1 pound lean beef, place it with ½ pint of water in a bottle which they will only half fill, and agitate violently for half an hour; then throw the whole on a sieve, and receive the liquid in a jug. Next, boil the undissolved portion in 1 pint of water for 20 minutes; strain, and mix the decoction with the cold infusion; evaporate the liquid to the consistence of thin syrup, adding spice, salt, &c., to suit the taste, and pour the essence, while boiling hot, into bottles (*see next receipt*), or jars, or (still better) tin cans, which must be closed up air-tight, and kept in a cool place. (*See No.* 1634.)

4617. To Fill Glass Bottles with Boiling Liquid. If boiling liquid be poured into cold bottles, there is a great risk of the bottle breaking, involving probably the loss of the contents. To prevent this, stand the bottles in a wide pan with sufficient cool water to reach nearly to the top of the bottles; pour sufficient water in each bottle to prevent it floating, and then let the water in the pan be brought gradually to a boil. As each bottle is to be filled, take it out of the pan, empty the water out of it, and fill it immediately.

4618. Ellis's Essence of Beef. Take lean beef, sliced thin, sufficient to fill the body of a porter bottle; cork it loosely, and place it in a pot of cold water, attaching the neck by means of a string to the handle of the pot; boil for 1½ or 2 hours, then decant the liquid and skim it. This can be seasoned and packed as in receipt No. 4616.

4619. Concentrated Essence of Ginger. Unbleached, well-bruised Jamaica ginger, 4 ounces; rectified spirit of wine, 1 pint; digest for 2 weeks, press and filter.

4620. Oxley's Concentrated Essence of Jamaica Ginger. The same as the preceding, with the addition of a very small quantity of essence of cayenne.

4621. Very Strong Concentrated Essence of Ginger. Bruised unbleached Jamaica ginger, 12 pounds; rectified spirit of wine, 2½ gallons; digest 14 days, press, strain, and reduce the essence by distillation to 1 gallon; cool and filter. This produces a most beautiful article. It is at once inexpensive and easily performed, as the spirit distilled off may be used with advantage for preparing the common tincture of ginger, and several other articles; 2 ounces of this essence are regarded as equivalent to 3 ounces of the finest ginger. A single drop swallowed will almost produce suffocation.

4622. Concentrated Essence of Ginger. Ginger and animal charcoal, both in coarse powder, equal parts; add enough rectified spirits of wine to perfectly moisten them, and after 24 hours put the mass into a percolator, return the first runnings 2 or 3 times, then change the receiver, and pour on spirit gradually as required, and at intervals, until as much essence is obtained as there was ginger employed. Quality excellent. The mass remaining in the percolator may be treated with fresh spirit until exhausted, and the tincture so obtained may be advantageously employed, instead of spirit, in making more essence with fresh ginger. The last portion of spirit in the mass may be obtained by adding a little water. (*See Percolation, No.* 41.)

4623. Concentrated Essence of Guaiacum. Guaiacum shavings, from which the dust has been sifted, 3 cwt. Exhaust the wood by boiling with water, as in preparing an extract, using as little of that fluid as is absolutely necessary; evaporate to exactly 1¾ gallons; let it stand until cold, stirring it all the time to prevent the deposit of resinous matter; put the whole into a bottle; add spirit of wine, 5 pints; agitate repeatedly for a week, then allow it to settle for 7 or 8 days, and decant the clear into another bottle. This preparation is frequently substituted for guaiacum shavings in the preparation of compound decoction of sarsaparilla. 1 pint of this essence is considered equivalent to 19 pounds of guaiacum in substance.

4624. Essence of Quinine. Take dilute sulphate of quinine, 1 drachm; rectified spirit, 1 fluid ounce; mix, add of dilute sulphuric acid (specific gravity 1.087 to 1.090), ½ fluid drachm (or less, on no account more), and agitate it thoroughly until solution is complete. A few drops added to water form an excellent wash for foul, spongy, and tender gums, loose teeth, &c.; also for weak hair.

Medicated Syrups.

Syrup is a concentrated solution of sugar in watery fluids. If made with pure water, it is termed *syrup* or *simple syrup*. Where the water contains one or more medicinal agents, it is called *medicated syrup*. Full information as to preparation, &c., will be found in Nos. 1356, &c.

4626. Syrup of Phosphate of Zinc. Phosphate of zinc, 192 grains; water, 11 fluid drachms; syrupy phosphoric acid (specific gravity 1.5), 5 fluid drachms; syrup, 10 fluid ounces. Rub the phosphate with the water, add the acid, and filter into the syrup. Each fluid drachm contains 2 grains of zinc phosphate and about 18 minims of dilute phosphoric acid. In this formula, avoirdupois weight and Imperial measure are adopted.

4627. Syrup of Phosphate of Quinine. Take of phosphate of quinia, 96 grains; water, 13½ fluid drachms; syrupy phosphoric acid (specific gravity 1.5), 2½ fluid drachms; syrup, 10 fluid drachms. Mix the acid with the water, add the quinia, and filter into the syrup. Each fluid drachm contains 1 grain of phosphate of quinine and acid equal to about 10 minims of the dilute phosphoric acid.

The same weight of quinia, prepared by precipitating an acidulated solution of the disulphate by solution of ammonia, collecting, washing, and drying at 100° Fahr., may be used, in the absence of the phosphate. In this formula avoirdupois weight and Imperial measure are intended.

4628. Syrup of Phosphate of Iron with Quinine. Take of phosphate of iron, 192 grains; phosphate of quinia, 96 grains; water, 7 fluid drachms; syrupy phosphoric acid (specific gravity 1.5), 9 fluid drachms; syrup, 10 fluid ounces. Rub the powders with the water, add the acid, and filter into the syrup. Each fluid drachm contains 2 grains of phosphate of iron and 1 grain of phosphate of quinine. In the absence of the phosphate of quinia, the same weight of quinia may be prepared as directed in No. 4627.

In this formula avoirdupois weight and Imperial measure are adopted.

4629. Easton's Syrup of Phosphate of Iron, Quinine, and Strychnine. Take of phosphate of iron, 192 grains; phosphate of quinia, or quinia prepared as directed in No. 4627, 96 grains; strychnia (in crystals), 3 grains; water, 7 fluid drachms; syrupy phosphoric acid (specific gravity 1.5), 9 fluid drachms; syrup, 10 fluid ounces. Rub the phosphate of iron with 5 drachms of the water in a glass mortar, dissolve the strychnia and quinia in the acid, previously mixed with the remaining 2 drachms of water; mix and filter into the syrup. Each fluid drachm contains 2 grains of phosphate of iron, 1 grain of phosphate of quinine, and $\frac{1}{32}$ part of a grain of strychnine.

In this formula avoirdupois weight and Imperial measure are adopted.

4630. Syrup of Phosphate of Iron and Strychnine may be prepared in the same manner as the last, omitting the phosphate of quinine.

4631. Phosphate of Iron. Dissolve 3 ounces sulphate of iron in 2 pints boiling distilled water, dissolve also 1 ounce acetate of soda and 2½ ounces phosphate of soda in another 2 pints boiling distilled water. Mix the 2 solutions, filter the precipitate through muslin, wash it with hot distilled water till the washings no longer form a precipitate with chloride of barium. Dry at a heat not exceeding 120° Fahr. (*Br. Ph*).

4632. Syrup of Phosphate of Iron. Phosphate of iron, 96 grains; water, 9 fluid drachms; syrupy phosphoric acid (specific gravity 1.5), 7 fluid drachms; syrup, 10 fluid ounces. Rub the phosphate of iron with the water in a glass mortar, add the phosphoric acid, and filter the mixture into the syrup. As thus prepared, it contains the same proportion of iron, about 2 minims less of the dilute acid (25 instead of 27), and rather more sugar than when prepared according to the British Pharmacopœia. The phosphate of iron is made by the Br. Ph. process, and dried at a temperature not exceeding 100° Fahr. The specimens found in the ordinary course of trade are not readily soluble in the acid. This want of solubility is believed to be due to the length of time they have been kept before sale, as the best results have been obtained with the phosphate only a few days old. In this formula avoirdupois weight and Imperial measure are adopted.

4633. Syrup of Phosphate of Manganese may be prepared in a similar manner with the following ingredients: Phosphate of manganese, 96 grains; water, 9 fluid drachms; syrupy phosphoric acid (specific gravity 1.5), 9 fluid drachms; syrup, 10 fluid ounces. Strength, 1 grain phosphate of manganese, and acid equal to about 25 minims of the dilute phosphoric acid in each fluid drachm. The *phosphate of manganese* is made in the same manner as the phosphate of iron, substituting sulphate of manganese for the sulphate of iron. In this formula avoirdupois weight and Imperial measure are intended.

4634. Syrup of Phosphate of Iron with Manganese. Phosphate of iron, 72 grains; phosphate of manganese, 48 grains; water, 8 fluid drachms; syrupy phosphoric acid, 8 fluid drachms; syrup, 10 fluid ounces.

Rub the powders with the water, add the acid, and filter into the syrup. Each fluid drachm contains ¾ grain phosphate of iron, ½ grain phosphate of manganese, and acid equal to about 30 minims of the dilute phosphoric acid, B. Ph. Avoirdupois weight and Imperial measure are understood in the above formula.

4635. Syrup of Phosphate of Iron and Lime. Take of phosphate of iron, 96 grains; phosphate of lime, 192 grains; water, 8 fluid drachms; syrupy phosphoric acid, (specific gravity 1.5), 8 fluid drachms; syrup, 10 fluid ounces. Mix the powders with the water in a glass mortar, add the acid, and filter into the syrup. Each fluid drachm contains 1 grain of phosphate of iron, 2 grains of phosphate of lime, and an amount of acid equal to about 30 minims of the dilute phosphoric acid, B. Ph. The *phosphate of lime* is made by precipitation from solutions of chloride of calcium and phosphate of soda, and dried at 100° Fahr., and should not be kept too long before use. In this formula avoirdupois weight and Imperial measure are adopted.

4636. Durand's Syrup of Phosphate of Lime. Take of precipitated phosphate of lime, 128 grains; glacial phosphoric acid, 240 grains; sugar, in coarse powder, 7½ ounces; distilled water, 4 fluid ounces; essence of lemon, 12 drops. Mix the phosphate of lime with the water in a porcelain capsule, over a spirit or gas lamp, or in a sand-bath; add gradually the phosphoric acid until the whole of the phosphate of lime is dissolved. To this solution add sufficient water to compensate for the evaporation, then dissolve the sugar by a gentle heat, and, when perfectly cold, add the essence of lemon. The syrup of phosphate of lime, thus prepared, is colorless, transparent, of an acid taste, and contains two grains of the phosphate of lime, and nearly four grains of phosphoric acid to each tea-spoonful. When diluted it forms a phosphoric lemonade, not unpleasant to the taste. Dose, a tea-spoonful.

4637. Wiegand's Syrup of Phosphate of Lime. Dissolve 1 ounce precipitated phosphate of lime in 1 fluid ounce water by means of 4 fluid drachms muriatic acid; filter, and add 6½ fluid ounces water; then add 12 fluid ounces sugar, and strain. Dose, a tea-spoonful. This preparation is not so acid as Durand's, which is thought to be an advantage in some cases.

4638. Syrup of Rhubarb. The officinal method of preparing the fluid extract of rhubarb employed for the syrup involves much concentration by evaporation, and results in an unsightly preparation, and liable to an objectional resinous precipitation. By a modified process a fluid extract of rhubarb, equal to the officinal in strength, is first obtained by repercolating rhubarb, in moderately fine powder, with a mixture of 3 parts officinal alcohol and 1 part water. This menstruum exhausts rhubarb completely with the greatest facility. To make the syrup, take of this fluid extract, 3 fluid ounces; sugar, 28 troy ounces; water, a sufficient quantity. Add the fluid extract to 12 fluid ounces of water, filter, make up the filtrate to the measure of a pint by adding water through the filter, and dissolve in it the sugar with the aid of a gentle heat, and strain through muslin. The result is splendid. An equal product is obtained by mixing the officinal fluid extract with water, letting it repose some hours, filtering, and then completing as above.

4639. Syrup of Rhubarb and Senna. Digest for 14 days 6 ounces each bruised rhubarb root and senna leaves, and 1½ ounces cardamom seeds, in 6 pints dilute alcohol; filter, and evaporate to 3 pints. Mix 12 ounces of this with syrup made of 2 pounds sugar evaporated to 1½ pints, and mix while hot. This produces a syrup of 30° Baumé, which will not ferment.

4640. Stewart's Simple Syrup of Rhubarb. Macerate 6 ounces bruised rhubarb in 4 ounces dilute alcohol; press and filter, and evaporate to 2 pints. Mix 8 fluid ounces of this tincture with 28 fluid ounces simple syrup.

4641. Procter's Compound Syrup of Hypophosphites. Take of hypophosphite of lime, 256 grains; hyposulphite of soda, 192 grains; hyposulphite of potassa, 128 grains; hyposulphate of iron (recently precipitated), 96 grains; white sugar, 9 ounces; extract of vanilla, ½ ounce. Dissolve the salts of lime, soda, and potassa, in six ounces of water; put the iron salt in a mortar and gradually add a solution of hypophosphorus acid till it is dissolved. To this add the solution of the other salts, after it has been rendered slightly acidulous with the same acid, and then water, till the whole measures 12 fluid ounces. Dissolve in this the sugar, with heat, and flavor with the vanilla. Without flavoring, this syrup is not unpleasant.

4642. Hypophosphite of Iron. Hypophosphite of iron is obtained when 128 grains of hypophosphite of soda, dissolved in 2 ounces of water, are decomposed with a slight excess of solution of persulphate of iron, and the white precipitate well washed on a filter with water.

4643. Parrish's Compound Syrup of Hypophosphites. Take of hypophosphite of lime, 1½ ounces; hypophosphite of soda, ½ ounce; hypophosphite of potassa, ½ ounce; cane sugar, 1 pound, troy; hot water, 20 fluid ounces; orange water, 1 fluid ounce. Make a solution of the mixed salts in the hot water, filter through paper, dissolve the sugar in the solution by the aid of heat; strain, and add the orange-flower water. Dose, a tea-spoonful, containing nearly five grains of the mixed salts.

4644. Compound Syrup of Phosphate of Iron. Dissolve 10 drachms protosulphate of iron in 2 fluid ounces boiling water; also dissolve 12 drachms phosphate of soda in 4 fluid ounces boiling water; mix the solutions and wash the precipitated phosphate of iron till the washings are tasteless. Dissolve 12 drachms phosphate of lime in 4 fluid ounces boiling water with sufficient muriatic acid to make a clear solution, precipitate it with water of ammonia, and wash the precipitate. To these two precipitates add 20 drachms glacial phosphoric acid dissolved in water; when clear add 2 scruples carbonate of soda, and 1 drachm carbonate of potassa. Next add sufficient muriatic acid to dissolve the precipitate; and lastly 2 drachms powdered cochineal mixed with 3 pounds (troy) sugar;

apply heat, and, when the syrup is formed, strain. It is a question whether a simple syrup of phosphate of iron is not equally efficacious with Professor Parrish's more complicated preparation given above, and known as *Parrish's Chemical Food.* Each tea-spoonful contains 1 grain phosphate of iron, 2½ grains phosphate of lime, with smaller quantities of the alkaline phosphates, all in perfect solution.

4645. Chemical Food. This is prepared by the same formula as Professor Parrish's (*see No.* 4644), omitting the cochineal and muriatic acid, and with this modification was adopted, as well as the two following receipts, by the Newark Pharmaceutical Association.

4646. Compound Syrup of Hypophosphites and Iron. Dissolve 256 grains each of the hypophosphites of soda, lime, and potassa, and 126 grains hypophosphite of iron, in 12 ounces water, by means of a water-bath. Filter, and add sufficient water to make up for the evaporation. Add 18 ounces sugar by gentle heat, to make 21 fluid ounces syrup. Each fluid ounce contains 12 grains each of the hypophosphites of soda, lime, and potassa, and 6 grains hypophosphite of iron. (*Newark P. A.*)

4647. Compound Syrup of Hypophosphites. Prepared by the same formula as the last, omitting the iron. (*Newark P. A.*)

4648. Aitken's Syrup of Iron, Quinia, and Strychnia. Dissolve 5 drachms sulphate of iron in 1 ounce of boiling water, and 1 ounce phosphate of soda in 2 ounces of the same. Mix the solutions and wash the precipitates on strainers until the washings are tasteless; dissolve 192 grains sulphate of quinia with sufficient sulphuric acid in 2 ounces of water, precipitate the clear solution by a very slight excess of water of ammonia, collect and carefully wash it. Dissolve both precipitates, and also 6 grains strychnia, in 14 ounces dilute phosphoric acid, then add 14 ounces white sugar, and dissolve the whole without heat. This syrup contains about one grain of phosphate of strychnia in each drachm. The dose might therefore be about a tea-spoonful 3 times a day. It is perfectly miscible with water, has a strongly styptic and chalybeate taste, and an after-taste of quinia. It is employed mainly as a preparative to the use of cod-liver oil, and in certain cases as a concomitant to this food substitute in scrofulous diseases, in cases of delicate children, with equal parts of the phosphatic syrup known as chemical food.

4649. Santonate of Soda. Put into a flask, 2 ounces santoninic acid, 4 fluid ounces pure caustic soda lye, and 12 fluid ounces distilled water. Heat the flask in a sand-bath or over a stove to 70° or 80° Fahr., until the santonine solution is complete; which usually requires about half an hour; then remove from the fire, and, when cold, it is conveniently evaporated.

4650. Syrup of Santonate of Soda. Boil 18 fluid ounces syrup until it marks 32° Baumé; let it cool a few minutes, then add 30 grains santonate of soda dissolved in 1 ounce distilled water. You obtain 18 fluid ounces of a transparent syrup, without a bitter taste, of 35° when cold. Each fluid ounce contains one grain of santonine. This syrup is an excellent vermifuge.

4651. Syrup of Ipecacuanha. Mix 2 fluid ounces officinal fluid extract of ipecacuanha with 30 fluid ounces syrup. (*U. S. Ph*). This syrup is said to become cloudy occasionally, and the following preparation claims to be free from this objection.

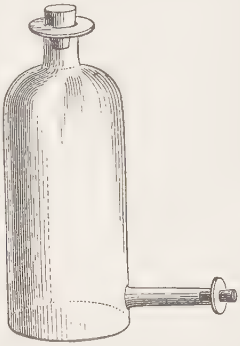
Moisten 2 troy ounces ipecacuanha with 1 fluid ounce diluted alcohol, and let it stand for 24 hours. Then transfer it to a conical percolator, and gradually pour upon it diluted alcohol until 1 pint of tincture has passed. Evaporate this by means of a water-bath to 6 fluid ounces, add 10 fluid ounces warm water, and, having rubbed it thoroughly with 45 grains carbonate of magnesia, in a mortar, filter, and add sufficient warm water through the filter to make the filtrate measure 1 pint; then add 29 troy ounces sugar, and dissolve it with the aid of a gentle heat, and, having strained the hot syrup, add sufficient warm water, through the strainer, to make it measure 2 pints when cold.

The same advantages are claimed for a syrup made in the following manner:—To 2 fluid ounces of the fluid extract made by repercolation, add 2 fluid ounces water and heat the mixture to the boiling point; then add 12 fluid ounces water, filter, and pour sufficient water through the filter to make the liquid measure 1 pint; in this dissolve 28 troy ounces sugar with the aid of heat, and strain through muslin. Both preparations will be perfectly clear, beautiful, and identical in strength and appearance, the latter possessing the natural odor and taste of ipecacuanha in an eminent degree.

4652. Compound Syrup of Squills. Take 4 troy ounces squill in No. 30 powder, and the same of seneka in No. 50 powder, mix them together, moisten with ½ pint diluted alcohol, and allow it to stand for an hour. Then transfer it to a conical percolator and pour diluted alcohol upon it until 3 pints of tincture have passed. Boil this for a few minutes, evaporate it by means of a water-bath to 1 pint, add 6 fluid ounces of boiling water, rub the liquid with 1 troy ounce carbonate of mangnesia in a mortar till thoroughly mixed, filter, and add through the filter sufficient warm water to make the filtrate measure 22 fluid ounces. Dissolve 42 troy ounces sugar in the filtered liquid, and, having heated the solution to the boiling point, strain it while hot. Then dissolve 48 grains tartrate of antimony and potassa in the solution while still hot, and add sufficient boiling water, through the strainer, to make it measure 3 pints when cold. Lastly, mix the whole thoroughly together. The above process is similar to that laid down in the U. S. Ph., except in the addition of magnesia before filtration, this being considered an improvement, as the gummy nature of the squills renders filtration unsatisfactory without it.

This syrup may also be prepared from the fluid extracts of squill and of seneka, by mixing 4 fluid ounces of each, evaporating the mixture by means of a sand-bath to a syrupy consistence; triturating this with the carbonate of magnesia, and proceeding precisely as in the above formula.

4653. Syrup of Ether. The combination of sulphuric ether with simple syrup, as usually prepared, is very unsatisfactory, whether for use alone, or mixed with other ingredients; a portion of the ether always separates and floats on the surface of the mixture, bringing with it also some impurities of the syrup. In pouring out a portion from the bottle containing it, the floating layer of ether and scum will come first, unless these be again mixed in by agitating the bottle. The following improvement is taken from the Paris Codex: Provide a bottle which has a small neck inserted in the side close to the bottom (*see illustration*); this, as well as the upper neck, should have a closely-fitting cork. The bottle must be of a size to contain 1 pint simple syrup and 1 ounce sulphuric ether. Insert these in it and shake well 3 or 4 times a day for 6 days; after which, if allowed to repose, a thin film of ether will rise and float on the surface of the syrup, separated from it by a layer of scum. The syrup, which is now saturated with ether, can be drawn through the lower neck, as required; it will be perfectly free from impurity, and no further separation of ether will take place.



4654. Compound Syrup of Black Cohosh. Macerate 2 ounces black cohosh (black snake-root), 1 ounce seneka root, ½ ounce liquorice root, and ½ ounce ipecacuanha root in dilute alcohol for 24 hours; then transfer to a percolator and run through two pints; evaporate the excess of alcohol by a water-bath, and convert into a syrup with sufficient quantity of sugar; lastly, treat 2 ounces wild cherry bark with half a pint of cold water, which add to the syrup previously cooled.

4655. Compound Syrup of Sarsaparilla. Reduce the following to moderately coarse powder, adopting the troy ounce throughout: 24 ounces sarsaparilla, 3 ounces guaiacum wood, 2 ounces each pale rose, senna, and liquorice root. Mix with 3 pints diluted alcohol, and allow the mixture to stand for 24 hours. Transfer to a cylindrical percolator, and displace 10 pints with diluted alcohol. Evaporate by a water-bath to 4 pints; filter, and add 96 ounces coarsely powdered sugar by the aid of heat, and strain while hot. Lastly take 5 minims each of the oils of sassafras and anise; and 3 minims oil of gaultheria; rub these oils with a small portion of the solution, and mix them thoroughly with the remainder. *(U. S. Ph.)*

4656. Scovill's Compound Syrup of Sarsaparilla. Take 8 ounces each sarsaparilla, burdock root and yellow dock; 6 ounces stillingia root (queen's root), 2 ounces turkey pea, 4 ounces false bitter-sweet, 3 ounces dandelion root, 3 ounces juniper berries, 1 ounce prickly-ash berries, 2 ounces guaiacum wood, and 9 ounces bamboo briar root. Coarsely bruise the above ingredients, and moisten them with alcohol. Let them stand 2 or 3 days, then put them in a steam displacement apparatus, and pass through the vapor of 3 pints strong alcohol. Continue the displacement with the steam of water till the strength is exhausted; set aside the 3 pints of tincture which first passed, and evaporate the remaining decoctions to 1 quart; mix this with the tincture, add 3 quarts sugar-house syrup, and, when cold, add 1½ ounces iodide of potassium.

4657. Osborne's Syrup. This is one of the most valuable preparations that can be made for children. Simmer 11¼ drachms each, rhubarb root, anise seed, and liquorice root, in 45 ounces boiling water over a slow fire till reduced to two-thirds. Then make a syrup with 4¾ troy pounds white sugar, add 2 13/16 drachms each manna and compound tincture of opium (paregoric), and 225 grains salt of tartar. In warm weather, add a wine-glass of French brandy.

4658. Syrup of Seneka. Evaporate 4 fluid ounces of the fluid extract (*see No.* 4598) by means of a sand or water-bath to a syrupy liquid, triturate this with ½ ounce carbonate magnesia, and gradually add 8 fluid ounces of water, constantly stirring; filter, and add sufficient water, through the filter, to make the liquid measure 8 fluid ounces, then dissolve in it 16 troy ounces sugar, with the aid of heat, and strain through muslin while hot. The product, for its permanence and elegant appearance, cannot be surpassed. To prepare this syrup directly from a fluid extract by merely mixing that with simple syrup, would render the preparation uncommonly thin, and introduce an excessively large proportion of alcohol, which would be an unquestionable and serious objection.

4659. Compound Chloroform Syrup. This formula for an anodyne containing chloroform will remain combined and mix readily with either spirit or water. Macerate for 2 or 3 days 16 grains resin of cannabis, 2 grains capsicum, and 8 drops oil of peppermint in 4 drachms chloroform and 1½ drachms ether; filter the product. To about 1 ounce syrup add ½ drachm each of water and perchloric acid, and dissolve in this by a water-bath, 16 grains muriate of morphia; when cold add 96 minims Scheele's hydrocyanic acid, add to this the filtrate first made, and syrup sufficient to make the whole up to 4 ounces.

4660. Syrup of Chloride of Iron. Place in a flask 437½ grains sulphate of iron, 5 grains sulphate of soda and 10 minims dilute sulphuric acid with 1½ fluid ounces syrup previously heated to nearly boiling point, and continue the heat until a ferrous sulphate solution is effected. In another flask place 386 grains chloride of barium, ½ fluid ounce syrup, and 1 fluid ounce water, and apply heat until dissolved. Pour the two solutions together and mix thoroughly by agitation for a few minutes, and throw the whole upon a paper filter in a glass funnel, arranged in such a manner that it may be kept hot. When the ferrous chloride has filtered through, test a small quantity with a drop of solution of ferrous sulphate; if a white precipitate occurs, a few more grains of sulphate of iron must be added and refiltered; then add the hydrochloric acid and fill into 4-ounce vials for further use. This syrup contains the same amount of metallic iron, minim for minim, as the tincture of chloride of iron of the U. S. Pharmacopœia.

4661. Syrup of Lactate of Iron. Dissolve 1 drachm lactate of iron in 6 fluid ounces boiling water, and add 12 drachms sugar. Dose, 2 to 4 tea-spoonfuls.

4662. Syrup of Bark and Chloride of Iron. Take 1 pint of the saccharine tincture of red bark, add to this 160 minims each syrup of chloride of iron and hydrochloric acid. This contains 120 grains of red bark and 10 drops of syrup chloride iron to each fluid ounce. If it be desirable to mix in any other proportion, add one measure of hydrochloric acid for each measure of syrup of chloride of iron. This is a deep red, clear tincture, rather pleasantly bitter; if any doubt exists as to whether it has blackened, add dilute alcohol to a small quantity, until it becomes transparent enough to observe it thoroughly.

4663. Lahache's Syrup of Iodide of Potassium and Iron. Take of iodide of potassium, 308 grains; iodide of iron (in solution 1 to 3), 230 grains; orange-flower water, 462 grains; simple syrup (concentrated), 33½ fluid ounces; dissolve the iodide of potassium in the orange-flower water, add the other solution and incorporate the syrup. Preserve it cool and free from light.

4664. Syrup of Tannate of Iron. Citrate of iron, 2½ drachms dissolved in 1 ounce diluted acetic acid, is added to 12 ounces simple syrup, 3 ounces raspberry syrup, and 1 drachm extract of galls rubbed up with a portion of the syrup.

4665. Phillip's Syrup of Sesquichloride of Iron. Dissolve 286 grains sesquioxide of iron in 1200 grains hydrochloric acid and 2 ounces water. Filter, and add 16 ounces simple syrup. Dose, a tea-spoonful.

4666. Syrup of Lactucarium. Triturate 1 troy ounce lactucarium to powder, and heat it with 8 fluid ounces water to the boiling point; maintain the temperature for a few moments, then strain by wringing through muslin; add to the strained liquid gradually, and with constant trituration, 120 grains carbonate of magnesia; filter through paper, pouring sufficient water through the filter to make the filtrate measure 8 fluid ounces, in which dissolve 14 troy ounces sugar with heat, and strain through muslin. This makes an excellent syrup and of fine appearance.

4667. French Syrup of Balsam of Copaiba. Triturate 2½ drachms calcined magnesia with the yolk of 4 eggs; thoroughly mix with this 5½ ounces balsam copaiba, and add 10¼ ounces simple syrup. This preparation keeps well.

4668. French Syrup of Santonin. Dissolve 55½ grains santonin in a little alcohol, add it to 16 troy ounces boiling simple syrup. The strength of the syrup will be about 3 grains to the ounce.

4669. Moore's Syrup of Tar. Take of tar (strained), 1 ounce (troy); pulverized sugar (refined), 12 ounces; carbonate of magnesia, 3 ounces, rubbed to powder on a sieve; alcohol, 2 fluid ounces. Mix the alcohol with 6 fluid ounces of water, rub the tar in a mortar of sufficient capacity with 1 ounce of the sugar, and then with the carbonate of magnesia, gradually added, until the whole is reduced to a uniform, pulverulent mixture. To this gradually add, with constant trituration, which should be continued for 15 or 20 minutes, 4 fluid ounces of the mixture of alcohol and water; then strain with strong expression. Return the residue to the mortar, and again triturate, first with 1 ounce of the sugar and then with the remaining 4 fluid ounces of the mixture of alcohol and water, gradually added, as before; finally strain and strongly express, and then reduce the dregs by trituration to a smooth and uniform condition, and pack firmly in a glass funnel prepared for percolation, and adjusted to the neck of a graduated bottle containing the remainder of the sugar, and pour upon this the expressed liquid; and when it has all disappeared from the surface, continue the percolation with water until the whole measures 1 pint. Agitate occasionally, until the sugar is dissolved, and strain if necessary. Dose from a dessert to a table-spoonful. The *strained tar*, such as is usually sold in gallon cans, answers well for this purpose, but when it is not at hand the crude tar may be dissolved in a small quantity of ether, and strained, and the ether allowed to evaporate spontaneously.

4670. Syrup of Capsicum. Take of cayenne pepper in fine powder, 2 drachms; carbonate of magnesia, 1 drachm; sugar, in coarse powder, 14 ounces, troy. Rub the cayenne pepper first with the carbonate of mangnesia and sugar, and then with 1 fluid ounce of alcohol, and slowly pour in water until 6 fluid ounces have been added. The whole is then to be transferred to a proper filter; and when the liquor has ceased to pass, pour on water until 9 fluid ounces of filtered liquor are obtained. To this add the remainder of the sugar, and by a gentle heat form a pint of syrup. Made in this manner syrup of capiscum is a pungent yellowish-brown syrup, each tea-spoonful of which contains nearly 2 grains of cayenne pepper

4671. Syrup of Valerianate of Ammonia. Take of valerianic acid, 2 fluid drachms; dilute alcohol, ½ fluid ounce. Saturate the valerianic acid with carbonate of ammonia, having previously mixed it with the diluted alcohol, then add the syrup sufficient to make ½ pint. Dose, a fluid drachm containing 2 grains of the valerianate.

4672. Syrup of Stillingia (Queen's Root). Take of queen's root, 3 pounds; prickly-ash berries, 1½ pounds; refined sugar, 18 pounds. Grind and mix the articles together; place the whole 4½ pounds in a convenient vessel, cover them with alcohol of 76 per cent., and macerate for three days. Then transfer the whole to a displacement apparatus, and gradually add alcohol until 5 pints of the alcoholic tincture have been obtained, which retain and set aside. Then continue the percolation with water until the liquor passes almost tasteless, add the sugar to it, and evaporate by gentle heat until 13 pints are obtained, to which add the reserved 5 pints of alcoholic tincture, and make 18 pints of syrup. It may be flavored with a sufficient quantity of the essence of sassafras if required. (*Am. Dis*).

4673. Compound Syrup of Stillingia (Queen's Root). Take queen's root and root of turkey corn, of each 2 pounds; blue flag-root, elder flowers, and pipsissewa leaves, of each 1 pound; coriander seed and prickly-ash berries of each ½ pound. Grind and mix the articles together; place the whole 8 pounds in a convenient vessel, cover them with alcohol of 76 per cent., and macerate for three days. Then convey the whole to a displacement apparatus, and gradually add alcohol until 4 pints of the alcoholic tincture have been obtained, which retain and set aside. Then continue the percolation with water, and of this second solution reserve so much as contains a sensible amount of spirit, and distill or evaporate the alcohol from it. Continue the displacement by water until the solution obtained is almost tasteless, and boil down this weaker infusion until, when added to the second solution after the evaporation of its alcohol, it will make 24 pints. To these two solutions combined, add 24 pounds of refined sugar and dissolve it by heat, carefully removing any scum which arises as it comes to the point of boiling; and if it exceeds 28 pints, evaporate to that point with constant stirring. Then remove from the fire, and, when nearly cold, add the 4 pints of reserved alcoholic tincture, and make 4 gallons of syrup, each pint of which will be equal to 4 ounces of the ingredients in medicinal virtue. (*Am. Dis.*)

4674. German Syrup of Rhubarb. Take of alkaline fluid extract of rhubarb, 3 fluid ounces (*see No.* 4591); oil of cinnamon, 3 minims; sugar, 36 troy ounces. Mix the oil of cinnamon with the fluid extract, then add sufficient water to make the whole mixture weigh 20 troy ounces; in this dissolve the sugar with the aid of heat, and strain. The above formula for syrup of rhubarb, of the Prussian pharmacopœia, is in officinal proportions, and yields a strictly officinal result.

4675. Alkaline Syrup Rhubarb. Take of alkaline fluid extract of rhubarb, 6 fluid ounces (*see No.* 4591); oil of cinnamon, 3 minims; sugar, 36 troy ounces. Mix the oil of cinnamon with the fluid extract; then add sufficient water to make the whole mixture weigh 20 troy ounces; in this dissolve the sugar, with the aid of heat, and strain.

4676. Syrup of Guaiac. Decidedly the most agreeable manner of administering guaiac in liquid form, so far as tried, is that of a syrup prepared as follows: Take of guaiac, 1 ounce; solution of potassa, ½ fluid ounce; sugar, 14 ounces, troy. Macerate the guaiac in the solution of potassa mixed with 2 fluid ounces of water for 2 or 3 days; then percolate with water till 8 fluid ounces of liquid are obtained, in which dissolve the sugar.

4677. Procter's Syrup of Tolu. Balsam of tolu and carbonate of magnesia, of each, ½ ounce; alcohol, 1 fluid ounce; refined sugar, 2½ pounds. Triturate the balsam of tolu and carbonate of magnesia together with 1 ounce of the sugar, gradually adding the alcohol, and then water enough to make the whole measure 12 fluid ounces. Filter, add water enough to make 1 pint of filtrate, to which add the rest of the sugar, and dissolve by a very gentle heat. If required, strain the syrup, while hot, through a damp cotton-flannel bag. This forms a beautiful, clear syrup, free from turbidness, possessing a decided taste of the balsam, with most of its medicinal virtues.

4678. Syrup of Chamomile. Take of fluid extract of chamomile, 4 ounces; syrup, 12 ounces. Mix with the syrup moderately warm, and strain through flannel. The preparation is as clear as that made from the flowers, with the convenience of being made at will. The dose is one-fourth that of the fluid extract, or from 2 to 4 drachms.

4679. Syrup of Hydrate of Chloral. Mix together 2 scruples hydrate of chloral, 1 drachm water, and 7 drachms simple syrup.

4680. Syrup of Citric Acid. Dissolve 60 grains citric acid in fine powder in sufficient warm or hot water, and add the solution to 16 fluid ounces syrup containing 30 minims spirits of lemon, shaking them all together until thoroughly mixed. Syrup made according to this formula has a better appearance, and retains its brilliance and flavor longer than that prepared according to the U. S. Pharmacopœia.

4681. Compound Syrup of Hemlock. Bruise well 2 ounces each of water hemlock (Phellandrium aquaticum) seeds, queen's-root (stillingia silvatica), and red Peruvian bark. Simmer them with 2 pints boiling water for 20 minutes; and, when cold, strain. Then evaporate to 1 pint, add 2 pounds white sugar, dissolve with a gentle heat, removing any scum that may arise, and strain the mixture while hot. Dose: 1 to 3 drachms 3 or 4 times daily.

4682. Cadet's Compound Syrup of Ipecacuanha. Mix 2 ounces each syrup of ipecacuanha and syrup of poppies, 1 ounce syrup of orange flowers, and 1½ oxymel of squill. 2 tea-spoonfuls constitute a dose in whooping-cough.

4683. Compound Syrup of Yellow-dock. Grind and mix together 2 pounds yellow-dock root (rumex), 1 pound bark of false bitter-sweet root, ½ pound American ivy bark, and ½ pound figwort. Cover them with 76 per cent. alcohol, and let them stand for 2 days. Then displace through a percolator with hot water 2 pints extract, which reserve. Continue the percolation with hot water, and reserve so much of this second solution as contains a sensible amount of spirit, distill the alcohol from it, and set it also aside. Continue the displacement with hot water until near exhaustion, and boil down this until, when mixed with the second solution, the two combined will make 12 pints. To the mixture of these two add 16 pounds refined sugar; dissolve by heat, carefully removing the scum, evaporate to 14 pints. When nearly cold add the 2 pints first reserved alcoholic tincture, making in all 2 gallons syrup. Each pint will contain the virtue of 4 ounces of the ingredients. (*Am. Dis.*)

4684. Corvisart's Syrup of Pepsine. Heat 15 parts by weight of syrup of cherries to 70° or 75° Fahr.; mix with 1 part starchy pepsine, and, after 30 minutes, filter.

4685. Goddard's Aromatic Blackberry Syrup. Make a syrup of the following ingredients: 2 pints blackberry juice, 1 pound sugar, 1 pint brandy, 6 nutmegs grated, ½ ounce bruised cinnamon, 2 drachms cloves, and 2 drachms allspice. The astringent properties of blackberry juice adapt it, particulary in combination with carminatives, to the treatment of bowel complaints.

4686. Compound Syrup of Assafœtida. The disagreeable smell and taste of assafœtida prevents to a great extent the general use of this valuable drug. Mr. Rambo, in the Journal of Pharmacy, proposes the following recipe, which unites the properties of assafœtida with those of wild cherry, and is free from above objections. Take 1 ounce assafœtida and 2 ounces carbonate of magnesia; rub these together, gradually adding 1 pint infusion of wild cherry bark, and filter. Transfer the filtrate to a bottle, and dissolve in it by agitation 24 ounces white sugar. This preparation resembles the syrup of wild cherry in appearance.

4687. Syrup of Milk. Evaporate, with constant stirring, 6 pounds of skimmed milk to 3 pounds; add 4½ pounds of sugar; dissolve with a gentle heat, and strain. It may be flavored with the addition of 1 ounce of cherry-laurel water. Milk may be preserved by first heating it, and, when cold, charging it with carbonic acid gas.

4688. Grimault's Syrup of Horseradish. Hager gives the following directions: 50 parts each of fresh scurvy-grass, buckbean, and watercress, 60 parts of horseradish, 40 of fresh orange berries, are infused with 3 parts of cinnamon in 50 parts white wine, and, after a day, expressed; 250 parts sugar are dissolved in the filtrate.

4689. Grimault's Iodinized Syrup of Horseradish. This contains 10 parts iodine, and 5 parts iodine of potassium, in 8000 parts of the above syrup of horseradish.

Oxymel.

An acidulous syrup made of honey and vinegar. The ingredients in an oxymel should preferably be of such character, and in such proportions, as to produce a mixture of the proper consistence without further evaporation.

4691. Simple Oxymel. Liquefy by heat 40 ounces (avoirdupois) clarified honey, and mix it with 5 imperial fluid ounces each acetic acid and distilled water. (*Br. Ph.*)

4692. Oxymel of Squills. Mix together 1 imperial pint vinegar of squills and 2 pounds (avoirdupois) clarified honey. Evaporate in a water-bath until it attains, when cold, a specific gravity of 1.32. (*Br. Ph.*)

4693. Clarified Honey. Melt a convenient quantity of honey by means of a water-bath, and then remove the scum. (*U. S. Ph.*)

4694. Honey of Roses. Moisten 2 troy ounces red rose, in moderately fine powder, with ½ fluid ounce diluted alcohol; pack it firmly in a conical glass percolator, and displace 6 fluid drachms with diluted alcohol. Reserve this, and percolate ½ pint more; evaporate this last by a water-bath to 10 fluid drachms, add the reserved liquid, and mix with 25 troy ounces clarified honey. (*U. S. Ph.*) Added to water, it makes an elegant astringent wash and gargle for foul and tender gums, sore mouth, sore throat, relaxed uvula, &c.

4695. Honey of Borax. Mix together 60 grains borate of soda in fine powder and 1 troy ounce clarified honey. (*U. S. Ph.*) A common application in sore gums, mouth, and lips, in thrush, salivation, &c.; also for sore nipples, excoriations, &c., a little being applied on the tip of the finger. Diluted with water it forms an excellent skin and mouth wash or lotion.

4696. Honey of Violets. Take of expressed juice of violets (clear), 1 fluid ounce; clarified honey, 2 ounces; mix without heat in a glass vessel. Used chiefly as a mouth wash, to perfume the breath, as honey of roses.

Elixirs.

A tincture with more than one base; or a compound of various medicinal substances held in solution by alcohol in some form. Under elixirs are included medicated wines, mixtures, &c.

4698. Elixir of Calisaya Bark. Reduce to a moderate powder, 8 ounces Calisaya bark; 4 ounces each orange peel, cinnamon, and coriander seed; ½ ounce each anise seed, caraway seed, and cardamoms. Percolate the above ingredients with 4 pints alcohol diluted with 12 pints water, and add 2 pints simple syrup.

4699. Ferro-phosphorated Elixir of Calisaya Bark. The percolate obtained in the last receipt, *without the syrup*, should be digested with fresh hydrated oxide of iron; this is obtained from the solution of tincture of chloride of iron (prepared according to the formula of the U. S. Pharmacopœia, *before the alcohol is added*), 8 ounces of which solution, precipitated by sufficient ammonia, furnish the requisite quantity of hydrated oxide of iron. After standing for 12 to 24 hours, with frequent shaking, test a small quantity with a few drops of tincture of iron; if it blackens with this test, more hydrated oxide must be added, until all the cincho-tannic acid is removed, which would otherwise blacken the iron salt hereafter to be added. When the oxide of iron test ceases to blacken, filter the mixture. After which add 2 pints simple syrup, and 2 ounces pyrophosphate of iron dissolved in the least possible quantity of water. Lastly, after standing for 12 hours, filter the whole. This produces a beautifully clear and pale colored ferro-phosphorate of Calisaya bark of an agreeable taste, and free from all blackness.

4700. Ferro-phosphorated Elixir of Calisaya Bark and Bismuth. This preparation is made according to the last formula, with the addition of 2 ounces citrate of bismuth, dissolved in a sufficiency of equal parts of water and liquor of ammonia at a gentle heat. The bismuth solution is added to the elixir at the same time as the pyrophosphate of iron, and the mixture filtered.

4701. Elixir of Calisaya Bark and Bismuth. This may be prepared in the same manner as the ferro-phosphorated elixir (*see No.* 4669); substituting, in the place of the pyrophosphate of iron, 2 ounces citrate of bismuth, dissolved as directed in No. 4700.

4702. Elixir of Peruvian Bark and Protoxide of Iron. Take 4 ounces Calisaya bark, 1 ounce cinnamon, 1 drachm caraway seed, and 6 ounces orange peel. Reduce them to coarse powder and percolate with 1½ pints each of alcohol and water. Next dissolve 4 ounces carbonate of iron in 4 ounces muriatic acid and 2 ounces nitric acid; dilute the solution with 8 ounces water, and filter; precipitate with sufficient liquor of ammonia, and wash the precipitate. Digest the wet precipitate with the percolated tincture for 24 hours, with occasional shaking. This must then be tested with a few drops of tincture of iron, for any cincho-tannic acid that may be left. (*See No.* 4699.) When all the acid has been removed, filter. and add 2½ pints simple syrup, and caramel to color; lastly, for every fluid ounce add 3 grains pure crystallized sulphuret of iron. This is said to be an excellent imitation of Nichol's preparation of Peruvian bark.

4703. Squibb's Liquor of Iodide of Iron. Take of iodine, 2 ounces; iron-wire, 5 drachms; sugar, 12 ounces. Make this sugar into syrup by boiling it up with 8 fluid ounces distilled water, and filtering through paper into a flask marked at the point up to which it holds 20 fluid ounces. Meanwhile shake the iodine and iron with 3 fluid ounces water in a small flask until a clear green liquid results. Add to this a small portion of the syrup, and filter the whole through a new filter into the syrup, keeping but a small portion of the solution in the filter at a time. Drain, but do not wash the filter; and, finally, add to the liquid in the bottle enough distilled water to make up 20 fluid ounces. Shake it well, and keep it in small bottles, filled and well stoppered.

4704. Physic's Bitter Wine of Iron. Take of iron filings, 3 ounces; ginger, bruised, gentian, bruised, each, 1 ounce; orange-peel, bruised, ½ ounce; strong old cider, 1 pint. Macerate in a bottle loosely corked, for 2 weeks or longer, then express and filter for use. A reaction occurs between the iron filings and the acid of the cider, resulting in the formation of malate, and perhaps some acetate of protoxide of iron, with the evolution of hydrogen gas, which swells up the ingredients, and requires that the maceration should be conducted in a bottle of twice the capacity of the ingredients. This preparation has a dark, almost black color, very bitter aromatic taste, and is a good, though not an elegant chalybeate, in the dose of a teaspoonful.

4705. Hubbell's Wine of Iron. Take citrate (of magnetic oxide) of iron, 128 grains; precipitated extract of Calisaya bark, 256 grains. (*See next receipt.*) White wine (sherry), 1 pint; curaçoa (the best), 5½ fluid ounces. Dissolve the precipitated extract of bark in the wine by aid of a sufficient quantity of citric acid, then add the citrate of iron, filter the solution, and add to it the curaçoa, and mix. The peculiarities of this preparation are, that it consists of iron and cinchona, and yet is free from any inky taste or appearance, is perfectly transparent, of a light brown color not very different from that of sherry wine, and a bitter, not disagreeable taste. The label claims for it the presence of citrate of the magnetic oxide of iron, as the ferruginous ingredient. The dose of this preparation is a tea-spoonful.

4706. Hubbell's Precipitated Extract of Calisaya Bark. The precipitated extract of bark employed by Mr. Hubbell is not the commercial extract, nor yet that of Wetherill, nor of Ellis, but is made by himself, by a process based on that of Mr. Herring, of London, for the manufacture of quinine. Any quantity of Calisaya bark is treated with a solution of caustic soda (2 parts to 100 of water), until it has removed the coloring matter, kinic and tannic acids, and extractive matters. The residue is washed with water, dried, and extracted with alcohol till exhausted, and the alcohol distilled off so as to obtain an extract. The extract consists almost wholly of quinia and cinchonia, and is free from tannin, and, though not soluble in wine alone, becomes so by aid of citric acid.

4707. Shinn's Bitter Wine of Iron. Take of sulphate of cinchona, 6 drachms; sulphate of quinia, 2 drachms; citrate of iron, 4 ounces; citric acid, 1 ounce; sherry wine, 4 pints; alcohol, 1 pint; orange syrup, 1 pint. Dissolve the sulphates and citric acid in 1½ pints of hot water, and the citrate of iron in ½ pint of the same; mix the solutions, and add the other ingredients.

4708. Aromatic Wine of Iron. Digest 1 ounce iron filings for 2 or 3 days in 3 fluid ounces lemon juice; add ½ ounce each bruised gentian and cinnamon, and 16 ounces Rhenish (or sherry) wine. After 24 hours decant and filter. Gentian contains no tannin, and will not blacken the iron in the solution.

4709. To Prevent Sediment in Preparations of Peruvian Bark. The formation of a sediment in this and other simple preparations of Peruvian bark may be avoided by displacing or digesting its powder first with a solution of soda which will extract the tannin, kinovin, &c.; after washing off the last traces of the alkali by means of water, the alcoholic or vinous tincture may then be prepared as usual, and will remain clear, because free from the principles extracted by the alkaline solution. The alkaloids of the bark do not dissolve in weak mineral alkalies.

4710. Cottereau's Wine of Cinchonia is made as follows: Dissolve 24 grains sulphate of cinchonia in 2 pints Madeira wine, and filter. Dose, 1 to 4 ounces.

4711. Wine of Calisaya Bark. Digest 1 part powdered Peruvian bark in 12 parts white wine for 24 hours, and filter. A similar preparation may be made of 20 parts of red wine and 1 part extract of Peruvian bark.

4712. Aromatic Mixture of Iron. Take Peruvian bark in powder, 1 ounce; columba root in coarse powder, 3 drachms; bruised cloves, 2 drachms; filings of iron, separated by a magnet, ½ ounce; digest for 3 days with occasional agitation in a covered vessel, with as much peppermint water as will give 12 ounces of a filtered product, and then add compound tincture of cardamoms, 3 fluid ounces, and tincture of orange peel, 2 fluid drachms. This mixture should be kept in a well-stoppered bottle. Properties, tonic, and valuable in various states of debility; dose from ½ to 2 fluid ounces.

4713. Procter's Rennet Wine. Take of fresh rennets (about 3), 24 troy ounces; chloride of sodium, 3 ounces; alcohol, 6 fluid ounces; white wine, 16 fluid ounces. Wash the rennets in water until perfectly clean, cut them up, and macerate them for 14 days with frequent agitation in the wine, then add the alcohol, and filter for use. Dose, 1 tea-spoonful immediately after eating.

4714. Wine of Wild Cherry Bark. Professor Parrish gives the following formula in his "Elements of Pharmacy." Alcoholic extract (from 24 ounces) of wild cherry bark, 5½ ounces; sweet almonds, 3 ounces; water, 1 pint; and cherry wine, 2 pints. Beat the almonds with the water to a paste, rub down the extract with ½ pint of the wine, and mix the two liquids in a bottle of the capacity of 3 pints, stop it closely, and permit it to stand for 3 days, with occasional agitation; then add the remainder of the wine, allow it to stand a week, and filter. By this mode of proceeding, opportunity is afforded for the development of the hydrocyanic acid before the menstruum is made so alcoholic as to retard the reaction which favors its formation. Thus made, wine of wild cherry bark is a transparent, wine-red liquid, having an astringent bitter-almond taste and odor. The dose of this preparation as a tonic and sedative is a tea-spoonful.

4715. Ferrated Wine of Wild Cherry. Exhaust 12 ounces bruised wild cherry bark of its tonic principles with alcohol, and carefully evaporate the alcoholic tincture so as to expel the alcohol; add 6 ounces water and ½ ounce hydrated sesquioxide of iron. Macerate this with occasional agitation for 6 hours, and filter into a bottle containing an emulsion of 2 ounces sweet almonds in 6 ounces water. When reaction has ceased, filter again, and add 12 ounces white sugar, and for every ounce thus prepared, add 24 grains citrate of iron, previously dissolved in water sufficient to make the whole fluid extract measure 24 fluid ounces. The addition of iron to the bitter principle and hydrocyanic acid of the simple extract of wild cherry should render it much more efficient as a tonic, and greatly add to the value of the preparation.

4716. Ferrated Elixir of Wild Cherry. Take of fluid extract of wild cherry bark, 4 fluid ounces; curaçoa cordial, 11 fluid ounces; pyrophosphate of iron, 256 grains; boiling water, 1 fluid ounce. Mix the fluid extract with the curaçoa cordial. Dissolve the pyrophosphate of iron in the boiling water, and mix all together. Dose, a tea-spoonful 3 times daily.

4717. Elixir de Garus. Digest 2 parts by weight each of aloes and myrrh, and 1 part Spanish saffron, in 24 parts of 60 per cent. alcohol, and 2 of diluted sulphuric acid. Filter.

Or: Digest for some hours 3 parts by weight each of aloes and myrrh, and 2 parts each of nutmegs and cloves, in 576 parts rectified spirit diluted with an equal weight of water. Then add 864 parts orange-flower syrup, 192 parts orange-flower water and 2 each of cochineal and Spanish saffron. Filter. Dose of either of the above preparations, 1 tea-spoonful 3 or 4 times a day. (*Prussian Ph.*)

4718. Elixir of Pepsine. Dissolve 1 part by weight starchy pepsine in 8 parts water; filter the solution, and add 3 parts elixir of garus and 4 parts syrup of cherries. Dose, 1, 2 or 3 table-spoonfuls twice during the meals.

4719. Corvisart's Elixir of Pepsine. Saturate 1 part by weight starchy pepsine with 15 parts elixir of garus. Macerate for half an hour in a covered vessel, and filter through wetted paper. Dose, 1 table-spoonful before or during meals.

4720. Mialhe's Elixir of Pepsine. Macerate 1 part by weight of starchy pepsine, and 5 parts sugar, in 2 parts proof spirit, 9 parts white wine, and 4 parts water, until the sugar is dissolved; then filter. Dose, 1 table-spoonful before or during meals. This has an agreeable taste.

4721. French Pepsine Wine. This is prepared by macerating starchy pepsine in 20 times its weight of white wine.

4722. Wine of Beef and Iron. Dissolve 1 ounce Liebig's extract of meat in 4 ounces water and ½ drachm bruised allspice; after standing 10 hours add 16 ounces sherry wine and 2 ounces syrup. Then dissolve 96 grains citrate of iron in 2 ounces water. Mix, filter, and add water to make the whole 24 fluid ounces. Each ounce contains 1 ounce fresh beef and 4 grains citrate of iron. Dose, 1 table-spoonful. This and the 6 following formulæ have been adopted by the Newark Pharmaceutical Association.

4723. Nutritive Wine. This is prepared in the same manner as the last receipt, omitting the citrate of iron. (*Newark P. A.*)

4724. Elixir of Pepsine, Bismuth, and Strychnia. Triturate 256 grains Hawley's pepsine with 2 ounces glycerine in 4 ounces water; dissolve 64 grains citrate of bismuth, 2 ounces orange-flower water, and add to the pepsine; then add 2 ounces deodorized alcohol, 4 ounces orange-flower water, 2 ounces syrup, and lastly 1 grain strychnia dissolved in a few drops acetic. Each fluid ounce contains: pepsine, 16 grains; citrate of bismuth, 4 grains; strychnia, $\frac{1}{16}$ grain. (*Newark P. A.*)

4725. Ferro-Phosphorated Elixir of Gentian. Take 1 drachm each coriander and mace; 1 ounce orange peel, 1 ounce gentian root. Reduce to powder and percolate with a mixture of 4 ounces deodorized alcohol, 4 ounces water, and 2 ounces orange-flower water; displace 10 ounces, dissolve in it 256 grains pyrophosphate of iron, add 6 ounces syrup, and filter. Each fluid ounce represents 16 grains pyrophosphate of iron and 30 grains gentian. (*Newark P. A.*)

4726. Wine of Pepsine. Triturate 160 grains Hawley's pepsine in 4 ounces sherry wine and 1 drachm dilute muriatic acid; pour this on a filter and pass 12 ounces more sherry wine through it. Each fluid ounce contains 10 grains pepsine. (*Newark P. A.*)

4727. Aromatic Elixir. Take 4 drachms orange peel, 2 drachms coriander seed, 2½ drachms angelica seed, and 1 drachm cochineal. Pulverize and percolate with 12 ounces deodorized alcohol and 10 ounces water. Add 5 ounces glycerine and 6 ounces syrup, to make 2 pints. This is a pleasant vehicle for administering nauseous remedies. (*Newark P. A.*)

4728. Elixir of Valerianate of Ammonia. Dissolve 96 grains valerianate of ammonia in 4 ounces water, and add it to a mixture composed of 6 drachms syrup of orange peel, 2 drachms tincture of prickly ash, and ½ ounce each of fluid extract of vanilla and compound tincture of cardamoms. Each drachm contains 2 grains valerianate of ammonia.

4729. Elixir of Taraxacum. Take of taraxacum root, 6 ounces (or fluid extract of taraxacum, 6 ounces); liquorice root, 1 ounce; simple syrup, 2½ pints. The dry ingredients must be reduced to a suitable degree of fineness for percolation. Moisten the powder with 6 ounces alcohol diluted with twice its bulk of water, then pack in a conical percolator and pour on of the alcohol and water mixture until 6½ pints are obtained, then add the syrup and mix them.

4730. Chloroform Elixir. Take 1½ ounces each chloroform, tincture of opium, tincture of camphor, and aromatic spirit of ammonia; 20 drops oil of cinnamon, and 2 ounces brandy. This is an excellent mixture for colic. Dose, ½ fluid drachm.

4731. Mynsicht's Elixir of Vitriol. This elixir is also known by the name of *acid aromatic tincture*. Take cinnamon, 2 ounces; lesser cardamoms, cloves, galanga root, and ginger, of each ½ ounce; sulphuric acid (specific gravity 1.845), 1 drachm; rectified spirit, (specific gravity .897 to .900), 2 pounds. Mix the acid and spirit, and pour them on the other ingredients reduced to a coarse powder; macerate for 8 days in a close vessel, with frequent agitation, then press it out and strain. It should be of a brownish-red color. (*Prussian Ph.*) Another formula directs as follows: Take sweet flag root, and galanga root, of each 1 ounce; ginger, cinnamon, cloves, and nutmeg, of each 3 drachms; lemon peel, 4 drachms; white sugar, 3 ounces; proof spirit, 2 pounds; dilute sulphuric acid, 3 ounces. Macerate for 6 days, then press and filter, so as to make 27 ounces. (*Austrian Ph.*)

4732. Elixir of Valerianate of Ammonia. Extract of valerian, 2 scruples; fluid extract of valerian, 2 fluid drachms; water, 7 fluid ounces. Dissolve the extract in the fluid extract and water, filter, and add valerianate of ammonia, 2 drachms; orange-flower water and simple syrup, of each ½ fluid ounce. Dose, a tea-spoonful.

4733. Goddard's Elixir of Valerianate of Ammonia. Valerianic acid (from the root), 6 fluid drachms; carbonic acid water, 8 fluid ounces; red Curaçoa cordial, 20 fluid ounces; orange-flower water, 8 fluid ounces; mucilage of gum-arabic, 2 fluid ounces. Saturate the valerianic acid with sufficient carbonate of ammonia diluted with the carbonic acid water, then add it to the flavoring ingredients and mucilage, and filter. Dose, a teaspoonful.

4734. Moore's Elixir of Valerianate of Ammonia. Take of valerianic acid, 1 fluid ounce; distilled water, 24 fluid ounces; inodorous alcohol, 12 fluid ounces; simple syrup, 12 fluid ounces; peach water, 8 fluid ounces; saturated tincture of red saunders, 4 fluid drachms; saturated tincture of recent orange peel, 1 fluid ounce; oil of bitter almonds, 5 minims; and oil of sweet orange, 20 minims. Mix the valerianic acid and the distilled water, and a sufficient quantity of carbonate of ammonia to saturate the acid; then add the other ingredients, with a sufficient quantity of caramel to impart a brownish shade to the mixture, and filter through paper.

4735. McMunn's Elixir of Opium. The following receipt is said to have been found among the effects of the late Dr. Chilton: Take 5 pounds of Turkey opium, cut in small pieces and dried, and put it into a large strong glass jar with a wide mouth, and pour on it sulphuric ether enough to a little more than cover it; then stop the jar tight with a glass stopper, to prevent its evaporation; set it away in a cool place, and stir it daily with a stick, so that all the lumps may be broken. At the end of a week drain off the ether, and again pour on as much more, and repeat stirring it every day for a week longer, when it may be drained off as before. Then stop the jar tight, and lay it down on its side, so that all the ether that accumulates near its mouth may be drained off, and repeat doing so until the opium is all dry. Then expose it to the open air for a few days. The sulphuric ether extracts from the opium the narcotine which is its most deleterious principle, and also deprives it of its peculiar noxious odor, so that the elixir will not smell of it thereafter. Now to free the opium of the smell of the ether, and to extract its valuable medicinal principles, boil it in water, as follows: Pour into a tin boiler 4 gallons pure soft water, and when hot (but not boiling), put in the opium, when a great ebullition will take place, which is owing to the evaporation of the ether. Then let it boil 10 or 12 minutes, occasionally stirring it, so that the lumps of opium may be all broken and dissolved. Then set it away till the next day, when it should be strained through a cloth strainer, and if there be not 4 gallons of the solution, pour on the residue of opium boiling water enough to make that quantity when it is strained and clear. When in the state of watery solution, it is better to be kept in stone crocks that will hold about 2 or 3 gallons each, and in a cool place; after standing 5 or 6 days the clear solution should be carefully dipped off into a large tin can. The skimmings and dregs should be strained, and when clear put with the other. To this 4 gallons of watery solution, add 5½ gallons alcohol and stir the mixture thoroughly; then cover the can tight, so as to prevent evaporation. After standing a few days, the clear elixir may be carefully dipped off into another can, and the dregs at the bottom strained, and, when clear, poured into the other. After standing undisturbed for a few weeks it will be fit to use. It will be equivalent to laudanum, both in its strength and the size of its dose.

4736. Compound Elixir of Taraxacum. As prepared by Mr. Candidus for Dr. Cochran, of Mobile. Reduce the following ingredients to a moderately fine powder: 6 ounces taraxacum root, 4 ounces wild cherry bark, 1 ounce gentian root, 2 ounces orange peel, 1 ounce cinnamon, 1 ounce coriander seed, 2 drachms each anise, caraway and cardamom seeds, and 1 ounce liquorice root. Dilute sufficient alcohol with twice its bulk of water, and moisten the powdered ingredients with 6 ounces of it, pack in a conical percolator and displace 6½ pints with the diluted alcohol.

Add to this 2½ pints simple syrup. Dose, from ½ to 1 ounce. This elixir is an excellent vehicle for quinine, the taste of which it completely destroys.

4737. Squibb's Ammonio-Pyrophosphate of Iron. Take of pyrophosphate of soda, 4 parts by weight; solution of tersulphate of iron, 8 parts; citric acid, 2¾ parts; water of ammonia, 6¾ parts. Dissolve the *pyrophosphate of soda* (which is prepared by first drying and then calcining common phosphate of soda) in 60 parts water by means of heat; cool the solution to 50° Fahr. and filter it into a bottle of the capacity of 250 parts. Then add the solution of tersulphate of iron (*see No.* 4816), shake the mixture well, fill the bottle up with water, again agitate it, and set it aside for 24 hours to settle. Decant the clear liquid from the precipitate by means of a syphon, and repeat the washing and decantation twice. Then pour the precipitate upon a strainer, drain it for 24 hours and transfer to a tarred porcelain basin. Upon the citric acid, contained in a suitable vessel, pour the solution of ammonia, a little at a time, with constant stirring, till the crystals are dissolved and the acid accurately saturated. Then add this solution to the precipitate in the basin, and apply heat. Stir the mixture constantly till perfectly dissolved, and evaporate the solution to 24 parts; then filter through paper. Finally pour the solution upon plates, dry the salt by a moderate heat, and keep it in well-closed bottles. The yield is a little more than 7½ parts. The salt is deliquescent, in the form of pale yellowish green scales.

4738. Ammonio-Ferric Alum. This elegant styptic remedy has recently been much prescribed, especially in leucorrhœa; it is made as follows: Take of crystallized protosulphate of iron, 8 ounces; sulphuric acid, 7 fluid drachms; nitric acid, 1½ fluid ounces; sulphate of ammonia, 18 drachms. Boil the sulphate of iron in 2 pints water and add to it the sulphuric acid; when dissolved, add the nitric acid gradually, boiling for a minute or two after each addition, until the nitric acid ceases to produce a black color; boil violently, to separate deutoxide of nitrogen, and reduce the liquid to about one half, then add the sulphate of ammonia and a little sulphuric acid and set it aside to crystallize. Wash the crystals thoroughly in a little cold water to which a small portion of sulphuric acid has been added. This salt is in elegant violet-tinted crystals. Its peculiar merit consists in its marked astringency without the stimulating properties of some of this class of salts. It is easily assimilated when taken internally. Dose, 3 to 6 grains, and while it controls excessive discharges, is often useful in correcting their cause. Though called an alum, this salt contains no alumina; it is similar to the double sulphate of potassa and iron, which is called iron alum, but is more soluble.

4739. Concentrated Infusion of Roses. Rose petals or leaves, 3 pounds; boiling water, 2 gallons; infuse 2 hours, with constant agitation, then press out the liquor in a very clean tincture press, strain through flannel or a hair sieve, add diluted sulphuric acid, 24 fluid ounces, agitate well, and filter through paper supported on coarse muslin; lastly, add 6 pounds finest white sugar broken up into small lumps, but perfectly free from dust and dirt. When dissolved, put the infusion into clean, stoppered green glass bottles, and keep it from the light in a cool place. Product very superior.

Or: Take rose leaves, acid, and cold water, as last, mix, and infuse for 48 hours in a clean, covered, earthenware vessel, then press out the liquid with the hands; filter, and add the sugar as before. Product very fine, and, keeps well. In employing the first formula, care should be taken that the utensils be perfectly clean, especially the press, and earthenware glazed with lead should be avoided. The pressing should also be conducted as rapidly as possible, to avoid the color being injured by the iron, though clean iron does not readily injure infusion of roses before the addition of the acid. Should not the infusion filter quite clear through paper, the addition of the whites of 2 or 3 eggs, diluted with 2 or 3 ounces of water, followed by violent agitation of the liquid for a few minutes, and repose for 1 or 2 hours, will usually render it fine, when it may either be decanted or filtered should it require it. It will now pass rapidly through ordinary filtering paper, and at once run clear.

4740. Elixir of Vitriol. Called also *aromatic sulphuric acid.* In order that elixir of vitriol may be miscible with water without precipitation, aromatics of an oleo-resinous nature cannot be used. Add gradually 3 troy ounces sulphuric acid to ½ pint alcohol, and pour 1 fluid ounce boiling water on 2 drachms red rose leaves; when both liquids have become cool, add 1 fluid ounce fluid extract of orange-peel, and add alcohol enough to make the whole up to 18 fluid ounces. Mix and filter. Elixir of vitriol thus prepared has a pleasant aromatic odor and flavor, and the beautiful red color of the rose leaves, heightened by the presence of the acid. It is miscible with water without turbidity, and a specimen, after long keeping, has deposited but a trace of sediment.

4741. Alcoholized Sulphuric Acid. To 3 parts rectified spirits, add, very gradually, 1 part sulphuric acid. It is usually colored by letting it stand over a little cochineal. Its properties are internally refrigerant, externally caustic. As a refrigerant, it is administered in doses of ½ fluid drachm to 1 pint water.

4742. Cantharidal Collodion. Take 8 troy ounces finely powdered cantharides, press it firmly in a cylindrical percolator, and pour on it 1½ pints stronger ether. When 15 fluid ounces have passed, set the liquid aside in a close vessel, and continue percolation with stronger alcohol until ½ pint more liquid is obtained. Set this last aside to evaporate spontaneously until reduced to 1 fluid ounce; then mix it with the reserved liquid. Next add 100 grains dry collodion cotton (*see next receipt*), and agitate until dissolved. (*U. S. Ph.*)

4743. To Prepare Gun Cotton for Collodion. To 10 troy ounces nitrate of potassa, add 15½ troy ounces sulphuric acid, and stir until uniformly mixed. When cooled below 122° Fahr., add ½ troy ounce cotton, freed from impurities, stirring with a glass rod; cover the vessel closely, and, after standing 24 hours, transfer the cotton to a larger vessel, and wash it, first with cold water until the washings cease to have an acid taste, and then wash with boiling water. Press it as dry as possible with the hand, pack it tightly in a conical percolator, and pour on it stronger alcohol until the remaining water is displaced. Lastly, press it as dry as possible with the hand. The cotton thus prepared, and dried at a temperature of 212°, weighs 336 grains.

4744. To Prepare Collodion. Mix 21 fluid ounces stronger ether with 6 fluid ounces stronger alcohol in a suitable bottle, add the quantity of moist prepared cotton (as prepared in the preceding receipt), and shake occasionally until dissolved.

4745. Morphia Collodion. Collodion, 30 parts; muriate of morphia, 1 part. Applied to the affected parts in obstinate neuralgia.

4746. To Administer Hydrate of Chloral. Physicians should prescribe only the crystals, and should be very certain that they are pure. The taste of hydrate of chloral is quite unpleasant, but orange-juice completely covers it, and so does peppermint water or essence of peppermint. If taken in aqueous solution, let the patient be directed to suck the juice of an orange immediately after swallowing the dose, or mix with the solution a little peppermint water, with syrup of tolu. The following is a good formula: Take chloral hydrate, 1 drachm; peppermint water, ½ ounce; syrup tolu, ½ ounce; water, 2 ounces. Dose, from ½ ounce to 2 ounces, as may be required. The mixture should not be prepared in large quantities, nor be kept for any length of time.

4747. Improved Formula for Chalk Mixture. To obviate unpleasant and dangerous souring of chalk mixture as commonly prepared, glycerine may be substituted for the sugar, according to the following formula: Take of prepared chalk and glycerine, of each ½ ounce; pure gum acacia, 2 drachms; cinnamon water and pure water, of each 4 ounces. Rub well together until thoroughly mixed. This mixture will keep during a whole summer. The glycerine exerts a positively soothing effect upon the bowels, as well as in some degree arresting fermentation.

4748. Phosphorated Ether. Dissolve 2 grains phosphorus in ½ drachm oil of peppermint; when dissolved add sulphuric ether, ½ fluid ounce; mix well. Dose, 2 to 6 drops. This was recommended by Augustin in epilepsy, paralysis, and other like nervous affections.

4749. Compound Spirit of Ether. This preparation is known by the name of *Hoffmann's Anodyne,* and consists of ½ pint ether, 1 pint alcohol, and 6 fluid drachms ethereal oil.

4750. Moore's Extract of Black Cohosh. Moisten black cohosh root (black snake-root, or cimicifuga racemosa) in No. 50 powder, with 95 per cent. alcohol, and pack closely in a displacer; add gradually more of the alcohol until the resinous portion is exhausted; evaporate the alcoholic portion to dryness, powder the product and pass it through a fine sieve. Proceed to displace with diluted alcohol (1 part alcohol to 2 of water) until the root is perfectly exhausted, evaporate the resulting product over a water-bath until it is of nearly the required consistence of a good extract, then mix the powdered resinous portion, while the fluid is still warm, and stir constantly until cold. In this way the resin is intimately and smoothly mixed with the extractive portion; is much more readily rubbed down with aqueous solutions, and contains all the active ingredients of the root; but, however carefully prepared, change of temperature is liable to separate the resin more or less from the extract.

4751. Procter's Alcoholic Extract of Arnica. Take arnica flowers, 12 ounces, troy; alcohol, 3 pints; water, 1 pint. Mix the alcohol and water, and pour 2 pints of the mixture over the arnica, previously finely bruised. Allow it to stand for 48 hours, pack it firmly in a percolator, and pour on the remainder of the mixture until 3 pints are obtained. Evaporate this tincture in a water-bath (or still) till reduced to a soft resinous extract.

4752. Medicated Oils. These are prepared by *infusion* or *decoction.* The bruised ingredients are either simply digested in 2 to 4 times their weight of olive oil for some days, or they are gently boiled in it until they become dry and crisp, care being taken that the heat towards the end of the process is not greater than that of boiling water. As soon as either process is complete, the oil is allowed to drain from the ingredients, which may be, if necessary, submitted to the action of a press. The product is usually strained through flannel or a hair sieve while still warm, and, after standing a week or 10 days to settle, the clear portion is decanted from the dregs. Green plants are usually employed for this purpose, but in many cases the dried plants, reduced to powder, and digested for 6 or 8 hours in the oil at the heat of hot water, with frequent agitation, yield a much more valuable product. These oils are nearly all employed as external applications only.

The oil is obtained from the following, in the green state: Balsam apple, the seeds first taken out; belladonna leaves; elder flowers; fox glove leaves; garden night-shade leaves; fox glove leaves; garlic; hemlock leaves; henbane leaves; juniper berries, crushed; white lilies; poison oak leaves; roses, the petals of the flowers; fresh rue; St. John's wort flowers; fresh tobacco leaves.

Others are used dry, and reduced to powder, such as: Cantharides (Spanish flies); capsicums; dried chamomile flowers; fenugreek seeds; marsh-mallow root; mudar bark; opium; pellitory root; black pepper, &c.

Medicated Waters. These are aqueous solutions of different substances for medicinal and other purposes. The methods of preparing them generally require special arrangements to dissolve the oils, &c., otherwise insoluble in water. (*See No.* 1070, *&c.*)

4754. Camphor Water. Pulverize 120 grains camphor in a mortar with 40 minims alcohol; triturate it first with ½ troy ounce carbonate of magnesia, then with 2 pints distilled water, added gradually. Filter through paper. (*U. S. Ph.*)

4755. Bitter Almond Water. Rub 16 minims oil of bitter almonds with 1 drachm carbonate of magnesia, adding 2 pints water gradually. Filter through paper. (*U. S. Ph.*)

4756. Cinnamon Water. Treat ½ fluid drachm oil of cinnamon in the same manner as in the last receipt. Or, by distilling 18 troy ounces coarsely powdered cinnamon in 16 pints water, preserving only the first 8 pints of the distillate. (*U. S. Ph.*)

4757. Fennel Water. Treat ½ fluid drachm oil of fennel in the same way as last receipt. Or, by distillation from fennel in coarse powder. (*U. S. Ph.*)

4758. Peppermint Water. Same as last, using ½ fluid drachm oil of peppermint, or 18 troy ounces peppermint. (*U. S. Ph.*)

4759. Spearmint Water. Same as last, from oil of spearmint.

4760. Lime Water. Take of lime, 2 ounces; distilled water, 2 quarts. Slack the lime with a little of the water; pour on the remainder of the water and stir them together; then immediately cover the vessel and let it rest for 4 hours. Keep the solution, with the undissolved lime, in glass-stoppered bottles, and when wanted for use, pour off the clear liquor. It is an anti-acid tonic, kills worms, and frees the bowels from slimy and morbific matter. It promotes digestion; it is valuable in looseness, scrofula, diabetes, and whites. Mixed with a decoction of Peruvian bark, it wonderfully strengthens the debilitated, and those threatened with atrophy.

4761. Lobelia Water. Lobelia leaves and capsules, or powder, 1 ounce; boiling water, ½ pint; brandy, ½ pint. Infuse a week. Good for sore and inflamed eyes, erysipelas, ringworms, &c.

4762. Fever Drink. The juice of a lemon; cream of tartar, 1 tea-spoonful; water, 1 pint. Sweeten with loaf sugar. When the patient is thirsty, let him drink freely.

4763. Saline Mixture. Take fresh lemon juice, 1½ ounces; carbonate of potassa, 1 drachm; white sugar, 3 drachms; pure water, 12 ounces; essence of peppermint, 30 drops. Mix. A tea-cupful to be taken often in inflammatory fevers and sore throat.

4764. Tar Water. Take of tar, 2 pints; water, 1 gallon. Mix, by stirring them with a wooden rod for a quarter of an hour, and, after the tar has subsided, strain the liquor, and keep it in well-corked-phials. Tar-water should have the color of white wine, and an empyreumatic taste. It is frequently used as a remedy in chronic bronchitis. It acts as a stimulant, raising the pulse and increasing the discharge by the skin and kidneys. It may be drunk to the extent of a pint or two in the course of a day.

4765. Tar Water. M. Magnes Lahens suggests a method of preparing this water, which is more expeditious and convenient than the plan commonly followed. He mixes the tar with sand, previously washed and dried, throws the mixture into a percolator, and shakes the instrument gently to secure proper adjustment of the mixture. Water is then poured on, the first part of the filtrate is rejected, and the latter portion is kept for use. He uses ½ ounce tar and 26 ounces of sand to obtain 2 pints of the medicated water, which corresponds in strength with that of the Paris codex.

4766. Camphor Water. Take ½ ounce of camphor and enclose it with a glass marble in a muslin bag; put this into a wide-mouthed bottle, such a one as is used for preserved fruit. Now fill up the bottle with water that has boiled a few minutes and has been allowed to become cold. The glass marble is used to keep the camphor from floating, which it otherwise would do. After about 3 days the water will become saturated with the camphor, and may be poured off as required. A wine-glassful is a dose. It is very useful as an anti-spasmodic in hysteric and nervous affections.

4767. Barley Water. Wash away with cold water all extraneous matter from 2 ounces pearl barley; then boil for a short time in ½ pint water, throw this away, and boil the parboiled barley in 4 pints water down to 2 pints, and strain.

4768. Distilled Water. Take 10 gallons of spring water; distill it, rejecting the first quart that comes over, and preserving the next 8 gallons of the remainder.

Solutions.

In pharmacy, a solution consists of water in which a certain fixed quantity of a soluble substance has been dissolved. (*See No.* 29).

4770. Solution of Acetate of Morphia. Mix 4 drachms acetate of morphia with 15 drops acetic acid, 1 pint distilled water, and ½ pint proof spirit. Dose, from 5 to 20 drops.

4771. Solution of Sulphate of Morphia. Dissolve 1 grain sulphate of morphia in 1 fluid ounce distilled water. Dose, 1 teaspoonful, used in the same cases as opium

4772. Compound Solution of Alum. Rub together 1 ounce each alum and sulphate of zinc; dissolve in 3 pints boiling water. If necessary, filter. This is detergent and astringent, and is used as a lotion for old ulcers, excoriations &c.; and, largely diluted with water, as an eye-wash and injection.

4773. Solution of Ammonio-Nitrate of Silver. Dissolve 44 grains pure crystallized nitrate of silver in 1 fluid ounce distilled water; add gradually ammonia water until the precipitate at first thrown down is very nearly, but not entirely, redissolved. This solution is used as a test for arsenious acid, in combination with which it forms a yellow precipitate, arsenite of silver.

4774. Solution of Chloride of Barium. Dissolve 1 drachm chloride of barium in 1 fluid ounce water, and filter the solution. Dose, 5 drops, gradually increased to 10 or 12 drops, 2 or 3 times a day, for scrofula, scirrhous affections, and worms. Is used externally, largely diluted, as a lotion in scrofulous ophthalmia; also as a test for sulphuric acid and the soluble sulphates, in contact with which it makes a heavy white precipitate, insoluble in either hydrochloric or nitric acid. It is said to detect the presence of $\frac{1}{10000}$ part of sulphuric acid.

4775. Solution of Diacetate of Lead—sometimes called *Extract of Lead.* Boil 27 ounces acetate of lead, and 16 ounces finely powdered litharge, in 3 quarts water for ½ an hour, constantly stirring; then add sufficient distilled water to make up 3 quarts. If required, filter, and keep in a closed vessel. This solution is almost the same in strength and preparation as the *solution of subacetate of lead* of the U. S. Pharmacopœia.

4776. Goulard's Water or Lotion. Mix 1½ fluid drachms diacetate of lead with 2 fluid drachms proof spirits and 1 pint distilled water. This lotion is sedative, refrigerant, and astringent. This is the *dilute solution of diacetate (or subacetate) of lead.*

4777. Donovan's Arsenic and Mercury Solution. Triturate 6 grains finely powdered pure arsenic, 16 grains pure mercury, and 50½ grains pure iodine, with ½ fluid drachm alcohol, until dry; then add gradually 8 fluid ounces water, triturating constantly; heat the mixture in a flask until it begins to boil, and, when cold and filtered, add sufficient water to make up to 8 fluid ounces 6 fluid drachms. Dose 10 to 30 drops, 2 or 3 times a day, soon after a meal, for scaly skin diseases.

4778. Standard Solution of Chloride of Calcium. Dissolve carefully 2 grains pure carbonate of lime in a little pure hydrochloric acid; evaporate the solution to dryness, and dissolve the residuum in 1 pint pure water. This forms the standard solution of 16° of hardness. 1 measure of this solution mixed with 15 of water constitutes a solution of 1° of hardness; 2 measures of it with 14 of water make a solution of 2° of hardness &c. This solution is the standard used in testing the hardness of water.

4779. Solution of Iodide of Potassium. Dissolve 10 grains iodide of potassium and 5 grains iodine in 1 pint water. Dose, 2 to 6 grains in the usual case where iodine is employed.

4780. Solution of Chloride of Calcium. Dissolve 4 ounces fused (or 8 ounces crystallized) chloride of calcium, in 12 ounces water, and filter. Dose from 10 drops to 2 drachms, for scrofulous tumors, &c.; also used as a test for sulphuric acid, in contact with which it throws down a white precipitate insoluble in nitric acid.

4781. Solution of Sulphate of Morphia. Dissolve 16 grains sulphate of morphia in 4 drops dilute sulphuric acid, 1 fluid ounce water, and 1 fluid drachm rectified spirit. Dose, 5 to 10 drops.

4782. Solution of Nitrate of Baryta. Dissolve 4 grains nitrate of baryta in 80 grains water. This is used in the same manner as chloride of barium (*see No.* 4774) for testing sulphuric acid, with the same results.

4783. Solution of Nitrate of Silver. Dissolve 1 drachm crystals of nitrate of silver in 1 fluid ounce distilled water. It must be protected from the action of light. This is employed as a test for soluble chlorides, any of which, slightly acidulated with nitric acid, will give a white, curdy precipitate (chloride of silver) when brought in contact with diluted nitrate of silver.

4784. Liquor of Potassa; Solution of Potash; Soft-Soap Lye. Take 1 gallon boiling distilled water; use sufficient of this to slack 8 ounces recently burnt lime in an earthen vessel; in the remainder of the water dissolve 15 ounces carbonate of potassa, and add the slacked lime. Cork the mixture closely in a vessel, and shake it frequently until cold, then allow it to settle and decant the clear liquid into clean, well-stoppered green-glass bottles. Liquor of potassa is antacid, diuretic, and resolvent. In indigestion, acid eructations, heartburn, &c., it may be taken with great benefit. It neutralizes the acid, and counteracts the morbid tendency of the stomach to acid secretion. Dose, 10 drops, gradually increased to 40. It is powerfully poisonous, and should be greatly diluted in anything not acidulous. When pure, it does not effervesce with acids, nor give a precipitate with lime-water, or with a solution of oxalate of ammonia. (*See No.* 101).

4785. Liquor of Soda; Solution of Soda; Soda Lye; Hard-Soap Lye; &c. The proportions are, crystallized carbonate of soda, 32 ounces (troy); recent quicklime, 9 ounces (troy); boiling water, 1 gallon; the lime being slacked with a little of the water. The product is stated to have specific gravity 1.061, and to contain about 5 per cent. of pure caustic soda. The process by which the above is made is similar to that noticed under "Liquor of Potassa." The test of its purity, and uses, are also the same. (*See Nos.* 4784 *and* 102.)

4786. Solution of Chloride of Lime. This solution, usually called *bleaching liquor,* is prepared of 1 part chloride of lime to 10 parts of distilled water (both by weight). That is, 2 ounces to the pint, or 1 pound to the gallon. This is the ordinary strength of that of the shops; but in that which is sold as Concentrated Solution of Chloride of Lime, the proportions are usually 3 parts of the chloride to 20 of water. That is, 1½ pounds per gallon. The British Pharmacopœia directs the chloride to be triturated with the water in a wedgwood-ware or porcelain mortar, and having transferred the whole to a stoppered bottle, to be well shaken, several times, for the space of 3 hours; lastly, the solution is to be filtered through muslin, and preserved in a stoppered bottle. The specific gravity of that of the Pharmacopœia is 1.035. On the large scale, the ingredients are usually placed in a carboy, or a stone-ware bottle, which they will only ⅔ or ¾ fill, and, after being corked or bunged close, agitated frequently for a day or two. A cork or bung of bees'-wax or gutta-percha should be used for the purpose, unless the vessel is a stoppered one. After repose for 2 or 3 days, the clear portion is decanted through a funnel choked with crushed glass into bottles. The last should be closely corked (preferably stoppered), and kept in a cool and dark place. Nothing metallic should be allowed to come in contact with it. (*See No.* 104.) A better plan of filtering the above is as follows: The neck of the funnel should be choked with some fragments of broken glass, over which a layer of smaller ones should be placed, and, over all, a thick layer of coarsely powdered glass. This is all the filtration necessary, and is much superior to that ordered in the Pharmacopœia, as the contact with the muslin, and the longer exposure, weaken the solution. The U. S. Pharmacopœia directs the solution of chloride of lime to be prepared by mixing 12 troy ounces muriatic acid with ½ pint distilled water; gradually adding 6 troy ounces marble in small pieces. Towards the close of the effervesence, apply a gentle heat, and, when the action has ceased, pour off the clear liquid, and evaporate to dryness. Dissolve the residue in 1½ times its weight of distilled water, and filter through paper.

4787. Solution of Chloride of Potash. This solution is also known as *Javelle's Bleaching Liquid; Eau de Javelle, &c.* This is best made by passing gaseous chlorine into a solution of 1 part of carbonate of potash in 10 parts of water, until the gas ceases to be absorbed. It may also be made by adding a solution of carbonate of potash to a solution of chloride of lime, with agitation, as long as a precipitate forms; the liquid being afterwards decanted or filtered. These processes are precisely similar to that for the soda solution, an equivalent portion of carbonate of potash being used. (*See Nos.* 4788, *&c.*)

4788. Solution of Chloride of Soda. Also variously called *Solution of Chlorinated Soda; Solution of Hypochlorite of Soda; Labarraque's Disinfecting Fluid; Eau de Labarraque.* Take of crystallized carbonate of soda, 12 ounces avoirdupois; distilled water, 1 Imperial quart; dissolve, and pass through the solution the chlorine evolved from a mixture of common salt, 4 ounces; binoxide of manganese, 3 ounces; sulphuric acid, 2½ fluid ounces, previously diluted with 3 fluid ounces water, heated in a retort together, and the gas purified by passing through a wash bottle containing 5 ounces water, before it enters the soda solution.

4789. Solution of Chloride of Soda. To a solution of chloride of lime (formed of chloride of lime, ½ pound; water, 3 pints), add a solution of carbonate of soda (formed of carbonate of soda, crystallized, 7 ounces; water, 1 pint), and, after agitation for about 10 minutes, decant or filter, and preserve the filtrate in a well-stoppered bottle, and in a cool and dark place. This is the formula of the Dublin Pharmacopœia, and often more convenient than the preceding one. A writer in Boettger's Notizblatt recommends that in preparing this solution from chloride of lime, bicarbonate of soda be used in place of sal-soda. There is no question but that the precipitate will be much less bulky, and more of the liquid will be recovered in a concentrated form by decantation.

4790. Solution of Ammonio-Sulphate of Copper. Dissolve 1 drachm of the ammonio-sulphate in 1 pint water, and filter. This is stimulant and detergent. Applied as a lotion to indolent ulcers; and, largely diluted, to remove specks on the cornea. Also used as a test for arsenical compounds, with which it throws down a green precipitate.

4791. Solution of Indigo. Place a stone-ware vessel containing 8 parts oil of vitriol in a tub of very cold water; add 1 part fine powdered indigo very gradually, to prevent the mixture from heating. The mixture should be stirred occasionally with a glass rod; and, when the solution is complete, allow it to repose for 48 hours. Then dilute with twice its weight of soft water, adding this also very gradually, to prevent heating. This precaution is necessary to prevent partial decomposition of the indigo, which would result in the formation of sulphurous acid and indigo green. This is the sulphate of indigo or *liquid blue* of trade. This solution is preferably prepared by using 5 parts *fuming* sulphuric acid instead of the 8 parts oil of vitriol. (*See No.* 98.)

4792. Solution of Carbonate of Ammonia. This is prepared by dissolving 1 part sublimed carbonate of ammonia in 3 parts water, and adding 1 part ammonia-water. Used in chemical analyses, and as a very delicate test for the presence of lime, from a solution of which it forms a white precipitate soluble in nitric or hydrochloric acid.

4793. Solution of Sulphuretted Hydrogen. Pass sulphuretted hydrogen gas through cold distilled water, recently boiled, until it will absorb no more. Keep in small bottles securely stoppered.

4794. Solution of Santonin. The insolubility of santonin in water impairs its utility as a vermifuge. Water, cold or warm, takes up the merest trace. Chloroform, absolute alcohol, the strongest acetic acid, turpentine, hot olive oil, and hot glycerine, are the only simple fluids that dissolve any appreciable quantity. But it separates from the oil and glycerine on cooling; and water added to the other solutions produces the same result. By the use of the following formula, however, a useful and effective solution may be obtained. Put 20 grains bicarbonate of soda and 3 ounces distilled water into a flask; keep the liquid near the boiling point and add 12 grains santonin, finely powdered, about 2 grains at a time, until the whole has dissolved. Solution is effected in about half an hour, during which time the water is reduced to 2 ounces, or, if not, may be reduced to that bulk, when 1 ounce will contain a full dose—6 grains of santonin. The solution is bright and permanent, strongly alkaline, free from odor and taste, except that of carbonate of soda. Carefully neutralized with acetic acid, an equally bright and permanent solution is formed. Both may be diluted to any extent with hot or cold water without impairing the solution of santonin. The whole, or nearly the whole, of the santonin is precipitated in its original form of colorless rectangular plates, with bevelled edges, immediately by mineral acids, and after some hours by excess of acetic acid.

4795. Miscible Copaiba. Mix transparent balsam of copaiba with half its volume of strong liquid of potassa of double strength. Different samples often require slightly different quantities of the solution of potassa; it is therefore best to mix them gradually and cautiously together. Should the mixture be opaque, a little more of one or other of the ingredients, as the case may be, will render it clear. No heat should be used. This article is miscible with water, with which it forms a kind of milk; and, from containing all the volatile oil of the copaiba, is a very valuable preparation. Its activity is considered equal to the balsam itself, and is given in similar doses.

4796. **Solution of Permanganate of Potassa.** M. Leconte prepares this solution in the following manner: Caustic potassa, 6 drachms; chlorate of potassa, 5 drachms; binoxide of manganese, 5 drachms. Dissolve the caustic potassa and the chlorate in a small quantity of water, and add the manganese; get rid of the water by evaporation, stirring constantly, and calcine the dry mass to a dark red for an hour in an untinned iron cup; allow to cool, and add a quart of plain water. Then boil for 5 minutes in a china capsule, and you will obtain a fluid of a slightly purplish tint; decant the solution, and wash the residue with such a quantity of water as to make altogether 2 quarts. When filtering is thought necessary, the liquid should be passed, not through paper, but through very fine sand. For dressing foul wounds, or for injection, use 1 drachm of this solution to from 3 drachms to 5 of spring water.

4797. **Reveil's Solution of Permanganate of Potassa.** The officinal solution of the British pharmacopœia consists of 80 grains of the permanganate dissolved in 1 imperial pint distilled water. This is about 1 part by weight to 110 parts water. M. Reveil recommends a standard solution of 10 parts permanganate to 90 of water, so that the solution contains 10 per cent. of permanganate. This latter strength is endorsed by the U. S. Dispensatory, which also recommends extreme cleanliness in its preparation and use, and of the bottles containing it, as organic matter more or less neutralizes its disinfecting and cleansing powers. The same authority orders the pencil or brush used for its application to be made of amianthus, or asbestos, in order to ensure its fullest effects. (*See No.* 1701.)

4798. **Directions for Using Permanganate of Potassa.** Reveil's standard solution (*see No.* 4797) may be used at its full strength for dressing cancerous sores and ulcers, applied with a pencil made of asbestos, or sprinkled over a dressing of the same material. For simple wounds or for injections, ½ fluid ounce of the solution may be diluted with 1 pint of water. For gangrenous wounds and scrofulous ulcers, or as a gargle in unhealthy ulcers of the mouth and throat, 1 fluid ounce to a pint of water. For a gargle in croup and diphtheria, or as a wash for the hands after dissecting, 2 fluid ounces to the pint. A dose administered internally may consist of 10 to 30 drops of the standard solution. (*U. S. Disp.*)

4799. **Aceto-Carbolic Solution.** Acetic acid (pyroligneous) 8°, 20 parts; pure carbolic acid, 5 parts; water, 75 parts. Mix the two acids and add the water. The acetic acid favors penetration through the epidermis. For tinea, apply the liquid once a day over the diseased parts by means of a brush. For scabies, sponge all the parts. The clothes, &c., of the affected individual should also be treated with the liquid. (*Lemaire.*)

4800. **Solution of Carbolic Acid in Water.** To obtain uniform solution, it is better to slack the carbolic acid with four times its bulk of hot water, and then to add a sufficiency of cold water; or the carbolic acid may be first mingled with alcohol, which causes more ready solubility, before the addition of cold water. Water will not dissolve more than one-twentieth of its bulk of carbolic acid.

4801. **Frank's Specific Solution of Copaiba.** Boil 2 parts balsam of copaiba, 3 parts liquor of potassa, and 7 parts water together for 2 or 3 minutes; put the mixture into a separator, and let it stand for 5 or 6 days; then draw it off from the bottom, avoiding the upper stratum of oil, and add to the clear liquid 1 part sweet spirits of nitre, perfectly free from acid; should it turn milky, a very little liquor of potassa will usually brighten it; but if it does not, place it in a clean separator, and let it stand, closely covered, for a few days, then draw it off from the bottom as before, and it will be perfectly transparent.

4802. **Mackenzie's Solution of Nitrate of Silver.** This is used for sponging the throat and fauces, for affections of those parts. Dissolve 20 grains nitrate of silver in 1 fluid ounce distilled water.

4803. **Solution of Hydrosulphuret of Ammonia.** Saturate strong water of ammonia with sulphuretted hydrogen gas, then add a second portion of water of ammonia, equal to that first used, and put into well-stoppered bottles.

4804. **Fowler's Solution; Solution of Arsenite of Potassa.** Boil 64 grains arsenious acid (in small pieces), and 64 grains bicarbonate of potassa, in 12 fluid ounces water, until the acid is entirely dissolved. When cold, add ½ fluid ounce compound spirit of lavender, and sufficient distilled water to make the whole mixture measure a pint. (*U. S. Ph.*)

4805. **Solution of Citrate of Magnesia.** Crystallized citric acid, 37 drachms; water, 268 drachms; carbonate of magnesia, 22 drachms. Dissolve the acid in the water, and mix the magnesia with it under constant stirring; filter, and add to the filtrate so much water as to bring the weight of the whole to 40 ounces. To prepare the lemonade, take of aromatized simple syrup, 4 ounces; pulverized citric acid, 48 grains; bicarbonate of soda, 64 grains. Fill into bottles of suitable size, add water and so much of the magnesia solution as is required, and cork and tie immediately. Keep in a cool place. This solution contains 80 grains of citrate of magnesia to the ounce of fluid.

4806. **Parisel's Solution of Citrate of Magnesia.** M. Parisel recommends the following method of preparing this article, which he has followed during two years, as being both simple and effectual: Take of powdered and well dried citric acid, 20 parts by weight; carbonate of magnesia, 12 parts; mix accurately, and enclose the powder in a slightly warmed and well-dried bottle, which must be kept well stopped. The mixture thus made is rapidly dissolved in three times its weight of water at the ordinary temperature; and, if the water be pure, the solution in a few minutes becomes perfectly transparent, without any precipitate. The salt preserves its solubility for a long time.

4807. **Solution of Tartrate of Soda.** Take of carbonate of soda, 1¾ pounds; tartaric acid, 1¼ pounds; crushed sugar, 2 pounds;

hot water, 2 gallons. Dissolve the soda in 1½ gallons of the water; the sugar in 1 quart; and the acid in 1 quart. When all have dissolved and cooled down, add the acid slowly to the soda solution, and mix with the sugar. Filter into strong 12-ounce bottles, to each of which must be added a few drops of strong essence of lemon, and 35 grains of bicarbonate of soda. Cork immediately and tie or wire the bottles; will keep for any length of time. This is considered a good substitute for solution of citrate of magnesia.

4808. Solution of Citrate of Potassa. Take of citric acid, ½ ounce, troy; bicarbonate of potassa, 330 grains; water, ½ pint. Dissolve the acid and bicarbonate in the water, and strain the solution through muslin. (*U. S. Ph.*)

4809. Effervescing Citrate of Magnesia. Take of citric acid, dried and powdered, 7 parts; heavy carbonate of magnesia, 5 parts; mix, and preserve in well-corked bottles.

4810. Effervescing Citrate of Magnesia. Take of powdered citric acid, 2½ ounces; powdered sugar, 8 ounces; mix and triturate to a fine powder, and drive off the water of crystallization by the heat of a water-bath. Add citrate of magnesia (prepared by fusion), 4 ounces; oil of lemon, 10 drops; and mix immediately; then add bicarbonate of soda, 3 ounces; and again triturate until the whole forms a fine powder, which must be preserved in well-stoppered bottles. From 1 to 3 table-spoonfuls, mixed in a tumbler of water, furnishes an effervescing draught, in which the undissolved portion is so nicely suspended that it can be taken without inconvenience.

4811. Effervescing Citrate of Magnesia. Take of crystallized citric acid, 20 grains; carbonate of magnesia, 14 grains; mix in a tumbler of cold water and drink the mixture whilst effervescing.

4812. Solution of Citrate of Bismuth. Put 2 ounces pure sub-nitrate of bismuth into a porcelain dish, add 1450 grains nitric acid of specific gravity 1.44; heat over a spirit lamp until the bismuth is dissolved; then add one fluid ounce water, and let stand until cold; then gradually add water, constantly stirring with a glass rod, until a further addition produces milkiness, or until the whole measures 1½ pints. Filter and set aside.

Next, dissolve 3 ounces citric acid in 1½ pints water, and exactly neutralize the acid with carbonate of soda dissolved in water. It is important that there shall be no excess of soda, as the resulting citrate of bismuth would be contaminated with the oxide after decomposition. Put the bismuth solution in a suitable vessel, and add, stirring constantly with a glass rod, sufficient of the solution citrate soda exactly to decompose; the precise quantity is known to have been added, when, after placing the whole upon a cloth filter, the washings, after having been suffered to run awhile until clear, first, fail to precipitate bismuth when dropped into water, and, second, show no precipitate upon the addition of a few drops of ternitrate of bismuth, a small quantity of which should be reserved for this purpose. When the liquid portion has mostly passed, pour water upon the filter until thoroughly washed from nitrate of soda, or until the water passes tasteless; then, after draining, transfer to bibulous paper, and dry by gentle heat.

4813. Bartlett's Preparation of Citrate of Bismuth. Dissolve 1 troy ounce subcarbonate of bismuth in 720 grains nitric acid; after effervescence has ceased, gradually introduce 1½ fluid ounces distilled water; add to this slowly, and with constant stirring, a solution of 600 grains citrate of potassa in 2 pints distilled water. Nitrate of potassa and citrate of bismuth are formed; the latter, being insoluble, is precipitated, and, being thoroughly washed with distilled water, may be dried on bibulous paper with a gentle heat.

4814. Solution of Citrate of Bismuth and Ammonia. Rub some citrate of bismuth with sufficient distilled water to reduce it to a uniform pasty consistence, and add cautiously, with constant trituration, strong water of ammonia until a solution is obtained, observing to avoid an excess of ammonia. Filter the liquid through paper, returning the first portions that pass, should they be turbid.

4815. Solution of Citrate of Iron. Dilute 1 pint of solution of tersulphate of iron with 2 pints distilled water; precipitate with water of ammonia in slight excess, constantly stirring. Transfer the precipitate to a muslin strainer, and wash it with water until the washings are nearly tasteless. Drain it, and put half of it in a porcelain capsule on a water-bath heated to 150° Fahr., add 5¾ troy ounces citric acid in coarse powder, and stir until the precipitate is nearly dissolved; then add sufficient of the reserved precipitate to fully saturate the acid. Lastly, filter the liquid, evaporate it at a temperature not over 150° Fahr., until it measures a pint. (*U. S. Dis.*)

4816. Styptic Solution of Perchloride of Iron. Mix together 12 fluid ounces muriatic acid and 5 fluid ounces water; pour the mixture, a small portion at a time, on 2 ounces avoirdupois of iron wire; aiding the complete solution of the wire by a gentle heat. Add 6 fluid drachms nitric acid, previously mixed with 2 ounces water; and evaporate the whole to 5 fluid ounces. Lastly, add water sufficient to make the whole up to 10 fluid ounces. (*U. S. Dis.*)

Lotions.

Solutions of medicinal substances in water, employed for external application. They may be made of any soluble medicaments that are capable of exerting their action by contact with the skin. Lotions have been divided into classes, as sedative, anodyne, stimulant, &c. *Sedative* and *refrigerant* lotions are commonly employed to allay inflammation; *anodyne* and *narcotic* lotions to relieve pain; *stimulant* lotions to assist the ripening of tumors, &c.; *detergent* lotions to clean foul ulcers, &c.; *repellant* and *resolvent* lotions to disperse tumors, remove eruptions, &c. Lotions are usually applied by wetting a piece of linen with them, and keeping it on the part affected, or by moistening the part with the fingers previously dipped into them. Lotions are more agreeable if made with rose water. A number of these preparations are here given, and others will be found by referring to the index, under their respective headings.

4818. Lotion of Nitric Acid. Mix together 2 drachms dilute nitric acid and 1 pint water. This lotion is stimulating and cleansing. It is very useful when applied to foul and fœtid ulcers; it is likewise of considerable value in ulceration of the bone and threatened inflammation. It was the favorite lotion of Sir Astley Cooper in cases of unhealthy ulcerations requiring the application of a stimulant.

4819. Anodyne Lotion. Crude opium, 2 drachms; warm water, 1 pint. Rub the opium for a few minutes in a mortar with a little of the warm water, then pour in the remainder of the water and mix them well. This is an excellent wash for painful and irritable ulcers and swellings.

4820. Astringent Lotion. Sulphate of zinc, 2 drachms; water, 1 pint; camphorated spirit of wine, 2 drachms; mixed together. This is an excellent lotion for piles, used night and morning.

4821. Compound Alum Lotion. A detergent and astringent lotion for old ulcers, chilblains, excoriations, &c., and, largely diluted, as an eye-wash and injection. Dissolve 1 ounce each of alum and sulphate of zinc in 3 pints boiling water; filter, if necessary.

4822. Camphorated Lotion. Diluted solution of diacetate of lead, 8 fluid ounces; spirit of camphor, 2 drachms; mix, and shake well. Refrigerant and anodyne. Employed in erysipelatous inflammations, burns, contusions, sprains, excoriations, &c.

4823. Spackman's Lotion for Inflamed Parts. Mix 1 drachm tincture of myrrh; 3 drachms tincture of camphor; 1 ounce rectified spirits of wine; 1 drachm Goulard's extract; 1 ounce solution of sulphate of morphia; 2 ounces tincture of arnica, and 4 ounces water.

4824. Lotion of Acetate of Lead. Dissolve sugar of lead, ¼ ounce avoirdupois, in distilled or soft water, 1 Imperial pint. Sometimes a little vinegar is added, a like quantity of water being omitted. Used in excoriations, burns, sprains, contusions, &c.; also as an occasional cosmetic wash by persons troubled with eruptions.

4825. Preventive Lotions. These are washes intended to prevent infection from personal contact with those laboring under contagious diseases. Most of the nostrums of this character are mere weak solutions of chloride of lime, corrosive sublimate, potassa, or acetate or diacetate of lead. (*See No.* 4830.)

4826. Lotion of Muriate of Ammonia. Dissolve sal-ammoniac in coarse powder, 1 to 4 drachms (avoirdupois), in water, 1 Imperial pint. A useful wash in itch, old ulcers, tender feet, sweaty feet and hands, swelled joints, &c.

4827. Strong Lotion of Hydrochlorate of Ammonia. Dissolve sal-ammoniac, 1 to 2 avoirdupois ounces, in water, 1 Imperial pint. In bruises and contusions, extravasations, glandular swellings and indurations, chilblains, &c., when the skin is not broken. Vinegar is often substituted for the whole or a part of the water, and sometimes ⅕ or ⅙ part of rectified spirit, or some brandy or rum is added.

4828. Lotion of Muriatic Acid. Mix hydrochloric acid (specific gravity 1.16), 1 fluid ounce, with water, 19 fluid ounces. For unbroken chilblains. Diluted with an equal bulk of water, it forms a useful lotion in lepra and other scaly skin diseases.

4829. Lotion of Nitrate of Silver. Dissolve crystallized nitrate of silver, 1 to 2 drachms avoirdupois; concentrated nitric acid, 20 drops; in distilled water, 1 ounce. Used as a liquid caustic to destroy corns and warts.

4830. Lotion of Chloride of Lime. Take of chloride of lime (best, fresh), ½ ounce avoirdupois; pure water, 1 Imperial pint; mix in a bottle, and agitate, occasionally, for 2 or 3 hours; after repose, filter the clear portion through a piece of calico that has been previously moistened with water, and preserve the filtrate in a stoppered bottle.

4831. Lotion of Chloride of Soda. As the last, but substituting chloride of soda for chloride of lime. Or: Take of chloride of lime, ½ ounce avoirdupois; water, ¾ Imperial pint; mix, &c., as before; then add of crystallized carbonate of soda, 3½ drachms; previously dissolved in water, ¼ pint; agitate the whole for 12 or 15 minutes, and filter, &c., as before.

4832. Lotion of Chloride of Potassa. As the last, but substituting 3 drachms dry carbonate of potassa for the carbonate of soda.

4833. Lotion of Prussic Acid. Mix medicinal prussic acid, ½ fluid drachm, with rectified spirit, 1 fluid ounce, and distilled water, 2 fluid ounces; cover the bottle with thick purple paper, and keep it in the shade. Recommended by Dr. Elliotson as a lotion to moisten the face both before and after shaving, as being very soothing to an irritable skin. It is poisonous.

4834. Sulphuretted Lotion. Dissolve sulphuret of potassium, 1 drachm avoirdupois, in distilled water, 1 pint Imperial. Used to render the skin soft, white, and smooth, particularly when there is a tendency to slight eruptions of a pustular or vesicular character. The addition of ½ to 1 ounce of glycerine improves it for present use.

4835. Carbolic Acid Lotion. Dissolve 5 grains carbolic acid in crystals, in 1 ounce water. As a lotion for foul ulcers, carbuncles, scabies, and lepra.

4836. Carbolic Acid Lotion for Burns. Mix 1 drachm liquid carbolic acid with 3 ounces linseed oil and 3 ounces lime-water.

4837. Lotion of Arnica for Bruises, Sprains, Burns, &c. Take 1 ounce of arnica flowers dried, and put them in a wide-mouthed bottle; pour just enough scalding water over them to moisten them, and afterwards about 1 or 1½ pints spirits of wine. In case of a burn or bruise, &c., wet a cloth in the arnica and lay it on the part affected. Renew the application occasionally, and the pain will soon be removed.

4838. Balm of Gilead Lotion. Balmgilead buds, bottled up in new rum, are very healing to fresh cuts or wounds. An excellent preparation to have in the house.

4839. Glycerine Lotion for Irritation of the Skin. Mix 1 ounce of glycerine with 1 pint water. It allays itching and removes dryness, &c., in various skin diseases. With the addition of 2 or 3 drachms of borax, it removes chaps from the lips, hands, and nipples.

4840. Startin's Glycerine Lotion to Allay Irritation. Take ½ drachm trisnitrate of bismuth; 1 fluid drachm tincture of foxglove; 1 fluid drachm dilute nitric acid; 4 drachms glycerine; and 8 fluid ounces rose-water. To allay the irritation in itch and some other skin diseases.

4841. Glycerine Lotion for Burns, Scalds, &c. Take 1 ounce glycerine, 2 ounces thick mucilage (gum-arabic dissolved in water), and 7 ounces lime water. For burns, scalds, chaps, excoriations, &c.

4842. Startin's Glycerine Lotion for Bruises, &c. Triturate together 1 ounce glycerine, 1 drachm extract of belladonna, and 3 ounces soap liniment. (*See No.* 4869.) For bruises, sprains, and swelled joints; also gouty, neuralgic, and rheumatic pains.

4843. Evaporating Lotions. These lotions are soothing and refrigerant if allowed to evaporate by free exposure; and stimulant, if the evaporation is prevented by covering the part with the hand, or a piece of oiled silk. They are useful applications in nervous headaches, restlessness, irritability of the skin, &c. Mix 1½ fluid ounces each of sulphuric ether, rectified spirit, and solution of acetate of ammonia, with 3½ fluid ounces rose-water. A simple evaporating lotion may be made with 1 part rectified spirit, and 4 to 6 parts water.

4844. Camphorated Evaporating Lotion. Dissolve ½ drachm camphor in 4 ounces rectified spirit and ½ ounce elder flowers; digest 24 hours and strain. This is a good calming lotion.

4845. Tar Lotion. Quicklime, 6 ounces; water, 48 ounces; slack, add tar 4 ounces, and boil to one half. This liquid consists of a solution of pyrolignite of lime and pyrogenous oil and resin. It may be advantageously employed in various chronic skin diseases, especially those affecting the heads of children.

4846. Lotion of Galls. Bruised galls. 2 drachms; boiling water, 1 pint; infuse an hour, and strain. Astringent. An excellent application to sore nipples, or to strengthen them before suckling; spirit of wine, 3 ounces, may be advantageously added, and a like portion of water omitted.

4847. Mercurial Lotion; or Black Wash. Calomel, 1 drachm; lime water, 1 pint; mix, and shake well. These are the usual proportions. The bottle should be well shaken before the lotion is applied. Black wash is a favorite application to all kinds of syphilitic sores.

4848. Yellow Lotion or Wash, Sometimes called Red Wash. Corrosive sublimate (in powder), ½ drachm; lime water, 1 pint; mix, and shake well. It should be well shaken before use. A common application to syphilitic and scrofulous sores.

4849. Lotion of Belladonna. Extract of deadly night-shade, 1 drachm; diluted solution of diacetate of lead, 1 pint; dissolve. Applied to tumors and glandular enlargements.

4850. Cazenave's Antipsoric Lotion. Sulphuret of potassium, 1 drachm; soft soap (pure), 2 drachms; water, 8 ounces; dissolve. An excellent remedy for the itch. It leaves but little smell behind, and does not soil the linen.

4851. Iodine Lotion. Tincture of iodine, ½ fluid ounce; iodide of iron, 12 grains; chloride of antimony, ½ ounce. Mix for a wash. It is a remedy for corns. Apply with a small brush. Or: Iodine, 1½ grains; spirits of wine, 3 tea-spoonfuls. Dissolve, and add 1 pint of water. A most excellent wash for scrofulous sores.

4852. Disinfecting Lotion. Liquor of common salt, 1 fluid ounce; water, ½ pint; Or: Chloride of lime, 3 drachms; water, 1 pint; dissolve. Both are good washes for foul ulcers, the itch, the teeth, to sweeten the breath and remove the smell of tobacco smoke, and for various similar purposes.

4853. Valuable Lotion for Wounds, &c. Camphor, 5 drachms, cut into small pieces, and dissolved in half a pint of spirits of wine in a closely corked bottle; when fully dissolved, add ½ pint of ox-gall and 60 drops of laudanum. Shake it well, and bottle for use. This has been a patent medicine, and is very efficacious in the cure of fresh wounds, cuts, bruises, swellings, sores, and inflamed and pained parts.

4854. Lotion for Mange. Corrosive sublimate, ¼ ounce; spirits of salt (muriatic acid), ½ ounce; water, 1 quart. Or: Corrosive sublimate, 1 drachm; sal-ammoniac, ½ ounce; water, 1 pint Or: To the last add strong decoction of white hellebore, ½ pint. Used for mange in horses, cattle, and dogs, when sulphur ointment fails.

4855. Lotion for Galls. Vinegar and spirit of wine, of each 4 ounces; sugar of lead, ½ ounce; water, ½ pint; mix. Or: Soap liniment and solution of acetate of ammonia, equal parts. Or: Sal-ammoniac, 1 ounce; muriatic acid, 3 drachms; water, 1 pint. Used by farriers for saddle-galls or warbles.

4856. Lotion of Chlorate of Potassa.—sometimes called *Cosmetic Solution of Potassa*—for bad breath. Dissolve powdered chlorate of potassa, ½ ounce, in distilled water, 12 ounces, and rose-water, 2½ ounces. Used as a wash in foul mouth, gums, &c., particularly where there is a scorbutic or syphilitic taint; also extensively by smokers, to deodorize the breath. Its daily use is said to give a rich healthy hue to the gums and lips.

Liniments. A semi-fluid ointment or soapy application for painful joints, swellings, burns, &c. The term is also occasionally extended to various spirituous and stimulating external applications. When they are of a thinner consistency they are called *embrocations*, although this distinction is not always observed. Liniments are generally applied by friction with the hand or fingers, or with some substance, such as a piece of flannel, capable of producing some amount of irritation of the skin. Sometimes a piece of linen rag dipped in them is simply laid on the part. The greater number of cerates and ointments may be converted into liniments by reducing their substance with almond or olive oil, or oil of turpentine. Besides those here given, others will be found in the index under their proper heads.

4858. **Good Samaritan, or Immediate Relief from Pain.** Take 2 quarts of 95 per cent. alcohol, and add to it the following articles: Oils of sassafras, hemlock, spirits of turpentine, balsam of fir, chloroform, and tincture of catechu and guaiacum, of each 1 ounce; oil of origanum, 2 ounces; oil of wintergreen, ½ ounce, and gum camphor, ½ ounce. The above is a noble liniment, and may be successfully employed in rheumatism, bruises, neuralgia, sprains, headache, burns, and spinal affections.

4859. **Hemlock Liniment.** Oil of hemlock, ½ ounce; camphor, in gum, ½ ounce; opium, ¼ ounce; spirits of wine, 1 pint. Mix. It is a first-rate rubefacient in inflammatory rheumatism, gout, quinsy, inflamed breast, white swellings, &c.

4860. **Morphia Liniment.** An excellent anodyne, which often allays pain when other means have failed. Put 3 grains pure morphia into a mortar; add gradually, during trituration, 1 fluid ounce warm oil of almonds; when the morphia is dissolved, add 1 ounce camphor liniment. (*See No.* 4880).

4861. **Magic Liniment.** Alcohol, 1 quart; gum camphor, 4 ounces; turpentine, 2 ounces; oil of origanum, 2 ounces; sweet oil, 1 ounce. For cuts or calks in horses or cattle in winter it has no equal; but it must be applied often. For human flesh use twice the amount of alcohol, and no liniment will be found superior to it.

4862. **Spirits of Camphor.** The gum resin camphor readily dissolves in alcohol, forming spirits of camphor. About 2 ounces camphor are generally dissolved in about 1 pint spirits. It is used as an external application for sprains, local pains, and stitches. It is applied by rubbing with the hand upon the painful part. To secure the full benefit of the application, the part should be afterwards covered with a piece of flannel of suitable size, more or less wetted with the spirits, and the whole covered with oil silk for the purpose of restraining evaporation.

4863. **Camphorated Oil.** This is a camphor liniment. The proportions are the same as in the preceding formula, substituting olive oil for the alcohol, and exposing the materials to a moderate heat. As an external stimulant application it is even more powerful than the spirits; and to obtain its full influence, the part treated should be also covered with flannel and oil silk. It forms a valuable liniment in chronic rheumatism, and other painful affections, and is specially valuable as a counter-irritant in sore or inflamed throats, and diseased bowels.

4864. **Arnica Liniment.** Add to 1 pint sweet oil, 2 table-spoonfuls tincture of arnica; or the leaves may be heated in the oil over a slow fire. Good for wounds, stiff joints, rheumatism, and all injuries.

4865. **London Liniment.** Take chloroform, olive oil, and aqua-ammonia, of each 1 ounce; acetate of morphia, 10 grains. Mix, and use as other liniments. Very valuable.

4866. **Valuable Embrocation.** Take ½ ounce camphor, cut it into small pieces, and dissolve it in ½ pint spirits of wine in a closely corked bottle; when completely dissolved, add 1 pint ox-gall (which can be had of any butcher), and about 40 or 50 drops laudanum; shake it well and bottle it for use. Apply lint dipped into it.

4867. **Hungarian Counter-Irritant Liniment.** Macerate for a week 1 drachm powdered cantharides, 1 drachm sliced garlic, 4 drachms each camphor, bruised mustard seed, and black pepper, in 6 fluid ounces strong vinegar and 12 fluid ounces rectified spirit; then filter.

4868. **Liniment for Wounds.** In 1 quart alcohol dissolve 1 ounce each saltpetre and gum camphor, and 1 table-spoonful of salt. When dissolved the liniment is ready for use, and is a magical remedy.

4869. **Steer's Opodeldoc, or Soap Liniment.** White castile soap, cut small, 2 pounds; camphor, 5 ounces; oil of rosemary, 1 ounce; oil of origanum, 2 ounces; rectified spirit, 1 gallon; dissolve in a corked bottle by the heat of a water-bath; and when considerably cool, strain, then add liquor of ammonia, 11 ounces; immediately put it in bottles, cork close, and tie over with bladder. It will be very fine, solid and transparent, when cold.

4870. **Liquid Opodeldoc.** Take 2 ounces castile soap shavings, and dissolve it in 1 quart alcohol, with gentle heat, then add 1 ounce camphor, ½ ounce oil rosemary, and 2 ounces spirits hartshorn.

4871. **Belladonna Liniment for Skin Diseases.** Take 4 drachms extract of belladonna, 1 ounce glycerine, and 6 ounces soap liniment. (*See No.* 4869.) For rheumatism, neuralgia, painful swellings, &c.

4872. **Black Oils.** Best alcohol, tincture of arnica, British oil, and oil of tar, of each 2 ounces; and slowly add sulphuric acid, ½ ounce. Extensively used as a liniment, particularly in cases where there is much inflammation.

4873. **Factitious Oil of Spike.** Oil of turpentine, 3 pints; oil of lavender, 1 pint; mix. Used by enamelers to mix their colors in. Or: Oil of turpentine, 1 gallon; Barbadoes tar, 4 ounces; alkanet root, 2 ounces; digest a week. Used as a liniment for horses.

4874. **Liniment of Cantharides.** Powdered Spanish flies, 1 drachm; oil of turpentine, 1 fluid ounce; digest 2 hours and filter. Or: Tincture of cantharides and soap liniment (*see No.* 4869), equal parts; mix. Both the above are irritant and stimulant, but should be used cautiously, lest they produce strangury.

4875. **Hydrochloric Acid Liniment.** Take of olive oil, ¼ Imperial pint; pure spermaceti and camphor, of each ½ ounce avoirdupois; balsam of Peru, ¼ ounce; mix by a gentle heat, add ½ fluid ounce hydrochloric acid, and stir until quite cold. An excellent friction for chilblains before they break. The balsam of Peru may be omitted if the cost be an object.

4876. **Compound Chloroform Liniment.** This is composed of 1 ounce each chloroform, ether, spirit of camphor, and laudanum, and ½ ounce tincture of cayenne pepper. For rheumatic pains.

4877. Petroleum Liniment. Mix together 1 ounce petroleum, ½ ounce camphor, and ½ drachm alcohol.

4878. Opium Liniment. Mix 2 ounces laudanum with 6 ounces soap liniment. (*See No.* 4869.) It constitutes an excellent soothing application in rheumatism, sprains, and other painful affections.

4879. Belladonna Liniment for Lead Colic. Take 40 grains extract of belladonna, 1 drachm rectified ether, and 2 fluid ounces cherry-laurel water. As a friction to the abdomen in lead colic.

4880. Compound Camphor Liniment, or Essence for Headache. Take of camphor, 2½ ounces avoirdupois; oil of lavender, 1 fluid drachm; rectified spirit, 15 fluid ounces; dissolve, then add of liquor of ammonia (specific gravity .882–.880), 5 fluid ounces, and shake them until mixed. It is powerfully stimulant, rubefacient, and counter-irritant. A piece of folded linen wetted with it applied to the part, and then covered with a towel, and pressed with the hand, or covered with a piece of oiled silk, will generally relieve superficial pains.

4881. Liniment Volatile, or Magic Pain Killer. Spirit of hartshorn, 1 ounce; olive oil, 1½ ounces; cayenne pepper, 2 drachms; laudanum, 2 drachms; 1 table-spoonful of salt and 2 of brandy. Shake well in a bottle. Rub the affected part with it, apply afterwards a rag saturated with it. It removes pains and swellings. It is a magic remedy.

4882. Instantaneous Pain Killer. Another and even more instant cure of pain is made as follows: Take aqua-ammonia, sulphuric ether, and alcohol, equal parts, and apply over the pain.

4883. Chilblain Liniment. Take 1 ounce of camphorated spirit, ½ ounce of the liquor of subacetate of lead. Mix and apply 3 or 4 times a day. This is Sir Astley Cooper's prescription, and a very efficacious remedy for chilblains.

4884. Rheumatic Liniment. Tincture of cayenne, oil of turpentine, olive oil, hemlock oil, gum camphor, sassafras oil, tincture of prickly ash, of each 1 ounce; powdered capsicum, or cayenne, 1 ounce; spirit of wine, 2 quarts; vinegar, 1 quart; ammonia, 1 quart; add 2 ounces gum camphor. Mix, put in a vessel, and stir occasionally till mixed and dissolved. This is a magic liniment, soon giving ease in rheumatic pains, gout, neuralgia, sprains, &c., &c. It seldom or never fails. "Good Samaritan" is also an excellent remedy for rheumatism. (*See No.* 4858.) Bathe the parts affected freely, and wet a piece of flannel and bind on the parts.

4885. Good Liniment for Rheumatics. Take 1 gill each of alcohol, beef's gall, spirits of turpentine and sweet oil, and 4 ounces gum camphor. Put them all in a bottle and shake it up; use it 2 or 3 times a day, a tea-spoonful at a time. Apply it to the parts affected, before the fire. It is good, also, for frost-bites.

4886. Liniment for Old Rheumatic Pains. A powerful liniment for old rheumatic pains, especially when affecting the loins, is the following: Camphorated oil and spirits of turpentine, of each 2 parts; water of ammonia, 1 part; laudanum, 1 part; to be well shaken together.

4887. Gebhard's Liniment for Sprains and Bruises. Mix together 2 ounces each oil of spike and British oil; 1 pint tanner's oil; ½ pint spirits of turpentine; put it into an iron or copper kettle placed over a fire, and carefully stir in ½ ounce sulphuric acid. When the whole becomes quite hot, cool and bottle. This is an excellent liniment for all kinds of sprains and bruises, and for horses or cattle it cannot be surpassed.

4888. Stimulating Liniment. Cayenne, 1½ ounces; salt, 1 table-spoonful; spirits of wine, 2 ounces; camphor, ½ ounce; spirits of turpentine, ¼ pint. Bottle, and shake now and then during one day. Then add ½ pint vinegar. It is excellent for sponging the body in cases of pain, debility, inflammation, rheumatism, gout, sore throat, numbness, neuralgia, &c.

4889. Embrocation for Bruises. Pour upon 2 ounces carbonate of ammonia (smelling salts) as much distilled vinegar as will dissolve it, then add 1½ pints common rectified spirit, and shake the whole together in a bottle. It is a good remedy for sprains and bruises.

4890. Cajeput Liniment. Mix together 7 ounces soap liniment (*see No.* 4869), ½ ounce camphor, and 1 ounce oil of cajeput.

4891. Cantharides Liniment for Chilblains. Mix together 2 ounces soap liniment and 1 ounce tincture of Spanish flies. Apply at intervals during the day.

4892. Compound Mustard Liniment. Take of oil of mustard, 1 fluid drachm; ethereal extract of mezereon, 40 grains; camphor, 120 grains; castor-oil, 5 fluid drachms; alcohol, 4 fluid ounces; dissolve the extract of mezereon and camphor in the alcohol, and add the oil of mustard and castor-oil.

4893. Nerve and Bone Liniment. Take 1 ounce spirits of turpentine, ½ pint brandy, and 1 gill neat's-foot oil. Simmer over a fire till mixed; then put it into bottles for use.

4894. Mustard Oil Ointment. Crude mustard-seed oil, 16 fluid ounces; ethereal oil of mustard, 30 drops; water of ammonia, 4 fluid ounces, or a sufficient quantity to form into a soap. Mix and bottle in broad-mouthed phials containing about 2 ounces.

4895. Wonderful Ointment. The following liniment is good for all sprains, bruises, lameness, &c.: Mix together 2 ounces oil of spike; 2 ounces origanum; 2 ounces hemlock; 2 ounces wormwood; 4 ounces sweet oil; 2 ounces spirit of ammonia; 2 ounces gum camphor; 2 ounces spirits turpentine. Add 1 quart 95 per cent. alcohol, mix well together, and bottle tight. This is an unequaled horse liniment, and, by omitting the turpentine, it constitutes one of the best liniments ever made for human ailments, such as rheumatism, sprains, &c.

4896. Horse Embrocation. Take ½ ounce each of oil of spike, oil of monarda (horsemint), and strong ammonia water; ½ ounce acetate of opium, 1 ounce chloroform, 2 ounces tincture of camphor, 1 ounce oil of origanum, and 2 ounces oil of camphor. This is said to be an excellent preparation.

Pills. This form of medicine is particularly adapted for administering nauseous substances, and such as operate in small doses. Extracts may be made into pills either alone or with the addition of any simple powder, as that of liquorice, to increase their consistence. Powders are usually beaten up with syrup, mucilage, conserve of roses, or extract of liquorice. Castile soap is frequently used for substances that are not decomposed by alkalies. When the mixed ingredients are made into a mass, it should be preserved in a bladder placed in a covered stone pot, and occasionally moistened with a little spirit, or spirit and water, to prevent it getting hard. In all cases the dry ingredients should be reduced to fine powder, and the whole beaten into a uniform mass of a proper consistence for rolling into pills. This is effected by rolling it on a slab into a convenient thickness, and dividing into pieces of the requisite weight, lastly rolling them between the thumb and finger, to give them a globular form. A *pill machine* is usually employed for dividing the roll and shaping the pills. In ordinary cases, rolling the pills in carbonate of magnesia or powdered starch is usually adopted, to prevent them sticking together while moist. For other pills not under this heading, see *Index.*

4898. To Sugar-coat Pills. To sugar-coat, place the pills dry and smooth in a round copper pan or porcelain dish. In another pan dissolve white sugar in water in the same proportion as for making simple syrup; and, when dissolved, slowly evaporate the syrup until it feathers; that is, when a small portion taken out with a ladle and drawn up between two fingers forms a thread. The pan with the pills is next suspended over a slow fire, a little fine flour is sprinkled over them, and immediately after a spoonful of the syrup is poured on, or enough to cover. The pan is now kept swinging or moving over the fire, care being taken not to burn the sugar by too much heat, until it is reduced to a fine dust. Then more sugar is added, and the swinging and drying continued until a coat of sufficient thickness is obtained.

4899. To Silver or Gild Pills. Pills are gilded and silvered by rolling them between the fingers slightly moistened with mucilage, and then shaking them up in a small gallipot covered with a piece of paper, along with a little gold or silver leaf, or a little powdered gold or silver.

4900. Aloes Pills. Make 1 ounce aloes and 1 ounce soap into a mass with water. Divide into 240 pills.

4901. Aloes and Assafœtida Pills. Take ½ ounce each powdered aloes, assafœtida, and soap, made into a mass with water. Divide into 180 pills.

4902. Aloes and Myrrh Pills. Mix 1 ounce aloes, ½ ounce myrrh, and ¼ ounce saffron, with sufficient syrup to make a mass. This is sufficient for 240 pills.

4903. Assafœtida Pills. Mix into a mass with water ¾ ounce assafœtida and ¼ ounce soap. Make into 120 pills.

4904. Sulphate of Quinine Pills. Mix ½ ounce sulphate of quinine with 1 drachm powdered gum-arabic, and make into a mass with honey. To make 240 pills, each of which will contain 1 grain of quinine.

4905. Quinia Pills for Chronic Intermittent Fever. Mix 20 grains sulphate of quinia, 2 grains powdered opium, and 5 minims oleo-resin of pepper, with sufficient syrup of gum-arabic to make a mass. Make into 20 pills. Dose, 2 pills every hour in the morning of an expected chill.

4906. Alterative Pills. Take 24 grains blue mass, 3 grains pulverized opium, and 3 grains powdered ipecacuanha. Make into 24 pills.

4907. Vegetable Anti-bilious Pills. Take 54 grains pulverized compound extract of colocynth, and 6 grains podophyllin (extract of may-apple or mandrake root). Make into 24 pills.

4908. Anti-chill Pills. Take 20 grains chinoidine, 40 grains ferrocyanuret of iron, 20 grains oil of black pepper, and 1 grain arsenic. Make up into 20 pills.

4909. Aperient Pills. Take 8 grains nux-vomica, 12 grains extract of henbane, and 48 grains compound extract of colocynth. Make into 24 pills.

4910. Diuretic Pills. Take 40 grains powdered castile soap, 40 grains dry carbonate of soda, and 20 drops oil of juniper. Make into 20 pills.

4911. Gonorrhea Pills. Take 48 grains powdered cubebs, 24 grains solid balsam of copaiba (powdered), 12 grains sulphate of iron, and 36 grains Venice turpentine. Make into 24 pills.

4912. Mandrake Mercurial Pills. Take 6 grains *podophyllin* (extract of mandrake or may apple), and 48 grains blue pill. Make into 24 pills.

4913. Podophyllin, Aloes, and Iron Pills. Take 3 grains podophyllin, 15 grains socotrine aloes, 15 grains extract of nux-vomica, 45 grains dry sulphate of iron, 10 drops oil of cloves, and sufficient syrup of gum-arabic to make into a mass. Divide into 30 pills. Dose, 1 pill immediately before each meal. A good remedy for indigestion, with costiveness.

4914. Opium Pills. Mix 2 drachms opium and 24 grains soap with water, to make 120 pills.

4915. Iodide of Iron Pills. Mix 1 drachm sulphate of iron, 4 scruples iodide of potassium, 10 grains tragacanth, and ½ drachm sugar with syrup. Make into 40 pills.

4916. Compound Iron Pills. Triturate together 2 drachms myrrh and 1 drachm carbonate of soda; then add 1 drachm sulphate of iron, and make up with syrup into 80 pills.

4917. Compound Cathartic Pills. Take ½ ounce compound extract of colocynth, 3 drachms extract of jalap, 3 drachms mild chloride of mercury, and 2 scruples gamboge; mix with water to make 180 pills.

4918. Copaiba Pills. Mix. 2 ounces copaiba with 1 drachm fresh magnesia; set it aside to dry, and, when the mass is of proper consistency, make into 200 pills.

4919. Mercurial Pills. These are commonly known as *blue* pills. Rub 1 ounce mercury with 1½ ounces confection of roses; add ½ ounce liquorice root, and divide into 480 pills.

4920. Calomel Pills. Mix ½ ounce mild chloride of mercury with 1 drachm powdered gum-arabic. Make up with syrup, into 240 pills.

4921. Compound Galbanum Pills. 6 drachms myrrh, and 2 drachms assafœtida, mixed with sufficient syrup. Make 240 pills.

4922. Rhubarb Pills. Mix 3 drachms powdered rhubarb and 1 drachm soap with water to make 60 pills.

4923. Compound Rhubarb Pills. Form into a mass with sufficient water; 1 ounce rhubarb, 6 drachms aloes, ½ ounce myrrh, and ½ fluid drachm oil of peppermint. Divide into 240 pills.

4924. Compound Pills of Squill. Mix 1 drachm powdered squill, 2 drachms ammoniac, and 2 drachms ginger, with 3 drachms soap. Make up with syrup into 120 pills.

4925. Compound Storax Pills. Take 6 drachms of storax, 2 drachms of powdered opium, and 2 drachms of saffron; work up to the proper consistency of a pill mass. Dose, from 5 to 10 grains.

4926. Sulphur Pills. The following formulæ furnish a convenient and neat method of administering sulphur when this useful medicine is required to be given as an alterative in chronic rheumatism and certain diseases of the skin: Take sulphur, 42 grains; castile soap, 18 grains. Mix and divide into 12 pills. 1 to 3 pills for a dose, morning and night. Or: Take sulphur and acetate of potassa, of each 24 grains. Make up with sufficient confection of roses into 12 pills. 1 or 2 twice a day in scorbutic and scrofulous cases, and when sulphur generally is indicated.

4927. Sulphite of Soda Pills. Dr. Polli, who introduced the sulphites to the notice of the medical profession in certain blood diseases, recommends the following formula: Take powdered sulphite of soda, 36 grains; powdered ginger, 12 grains. Make up with mucilage into 12 pills. Dose, 1 to 3 soon after eating. These are given when the stomach is foul, and the food ferments and becomes putrescent. The sulphite of magnesia, Dr. Polli says, is better for this purpose than sulphite of soda. Sulphur obtained by decomposing precipitated sulphide of copper, called *brown sulphur*, is stated by Dr. J. Hannon, an English Physician, to be a most powerful remedy against gout and rheumatism.

4928. Pepsine and Iron Pills. Mix together 2 drachms 34 grains starchy pepsine, and half that weight of iodide of iron in crystals, with sufficient syrup to make 100 pills. Cover them with 2½ drachms reduced iron, and finish with sugar-coating.

4929. Compound Taraxacum Pills. Take ½ drachm extract of taraxacum, and 10 grains blue pill. Make into 10 pills. Dose, 1 pill three times a day, in dropsy with disease of the liver.

4930. Pills of Iodide of Iron. Mix ½ troy ounce iodine with 1 fluid ounce water in a thin glass bottle; add 2 drachms iron wire in small pieces, and shake together until a clear green solution is formed. Mix 1 troy ounce sugar, ½ troy ounce marshmallow, 1 drachm gum-arabic, and 1 drachm reduced iron, all in fine powder, in a porcelain capsule. Filter upon them, through a small filter, first the green solution, heated, and afterwards 2 fluid drachms water. Evaporate over a water-bath with constant stirring, to a mass, and divide it into 300 pills. Dissolve 60 grains balsam of tolu in 1 fluid drachm ether, shake the pills in the solution until uniformly coated, and place them on a plate, occasionally stirring them until dry. Keep in a well stoppered bottle. (*U. S. Ph.*) The iodide of iron pills, as ordinarily prepared, crumble by time and exposure; but, made according to the above formula, they will undergo no change. This is the plan proposed by Prof. Procter in imitation of *Blancard's Pills.* (*U. S. Dis.*)

Ointments, Salves, and Cerates.

Ointments are unctuous preparations, that merely differ from cerates in consistence, being made and used in a similar manner. Their solidity should not exceed that of good butter, at the ordinary temperature of the atmosphere. When the active ingredients are pulverulent substances, nothing can be more suitable to form the mass of the ointment than good lard, free from salt; but when they are fluid, or semi-fluid, prepared suet, or a mixture of suet and lard, will be necessary to give a proper consistence to the compound; in some few instances wax is ordered for this purpose. Glycerine is now frequently prescribed in ointments, and is difficult to mix. Suppose it be ordered with zinc ointment, as is often the case, do not use ready-made zinc ointment, but weigh the proper quantity of oxide, rub the glycerine with it, and then add the lard. This makes a good smooth ointment which does not separate. Of course, the same plan can be adopted with any other powder. If there be no powder, melt the ointment, but do not let it get too hot, and beat the glycerine in and stir till cold; it then mixes much better; but still, if there be a large proportion of glycerine, it will separate after a time. (*See No.* 5009, *&c.*) Unctuous preparations may be prevented from getting rancid, by dissolving in the fat a little gum-benzoin or benzoic acid. The term *cerate* is applied to those unguents which contain wax. A number of these preparations are given here, and others will be found, by referring to the Index, under their respective headings.

4932. Simple Cerate. Melt together 8 ounces lard, and 4 ounces white wax, stirring constantly until cold. (*U. S. Ph.*)

4933. Spermaceti Cerate. Melt together 2 ounces spermaceti, 8 ounces white wax, and 1 pint warm olive oil, and stir assiduously until cold. This is used as a soft cooling dressing. As soon as the materials are melted, they should be moved from the fire, strained into a clean vessel, and stirred until cold. To facilitate the cooling, the vessel may be placed in cold water or a current of cold air. This will render the product both whiter and finer than when allowed to cool by itself. The operation of melting should be performed in a water-bath. On the large scale lard or suet is substituted for oil, by which means less wax is required. The following is a good form where a cheap article is wanted: Clarified mutton suet, 5½ pounds; white wax and spermaceti, of each ¾ pounds. As above.

4934. Chilblain Ointment. Take of gall-nuts, in very fine powder, 1 drachm avoirdupois; spermaceti cerate (*see No.* 4933), 7 drachms; mix, add pure glycerine, 2 drachms, and rub the whole to a uniform mass. An excellent application to obstinate broken chilblains, particularly when used as a dressing. When the parts are very painful, 1 ounce of compound ointment of galls may be advantageously substituted for the galls and cerate ordered above. (*See No.* 5006.)

4935. Family Salve. Take the root of yellow dock and dandelion, equal parts; add good proportion of celandine and plantain. Extract the juices by steeping or pressing. Strain carefully, and simmer the liquid with sweet cream, or fresh butter and mutton tallow, or sweet oil and mutton tallow. Simmer together until no appearance of the liquid remains. Before it is quite cold, put it into boxes. This is one of the most soothing and healing preparations for burns, scalds, cuts, and sores of every every description.

4936. Salve for All Wounds. Take 1 pound hog's lard, 3 ounces white lead, 3 ounces red lead, 3 ounces bees'-wax, 2 ounces black resin, and 4 ounces common turpentine; all these ingredients must be put together in a pan, and boil ¾ of an hour; the turpentine to be put in just before it is done enough, and give it a gentle boil afterwards. This is an excellent cure for burns, sores, or ulcers, as it first draws, then heals afterwards; it is excellent for all wounds.

4937. Lard Ointment. Melt 2 pounds pure lard, add 3 fluid ounces rose-water, and beat them well together while hot. When cold, separate the congealed fat from the water. This is simple lard ointment.

4938. Savine Ointment. Savine tops, dried and in fine powder, 1 drachm; ointment of white wax (simple ointment), 7 drachms; mix by trituration.

4939. Simple Ointment of White Wax. Olive oil, 5½ fluid ounces; white wax, 2 ounces; melted together and stirred while cooling.

4940. Spermaceti Ointment. Melt together 5 ounces spermaceti, 14 drachms white wax, and about 1 pint olive oil. The article commonly sold as spermaceti ointment is composed of 1 pound spermaceti, ½ pound white wax, and from 3 to 6 pounds pure lard.

4941. Camphor Ointment. Camphor, finely powdered, 1 ounce; lard, 2 ounces. Mix. It is designed to ripen indolent tumors.

4942. Compound Iodine Ointment. Mix 1 drachm iodide of potassium in very fine powder, with 2 ounces lard; then add ½ drachm iodine dissolved in 1 fluid drachm rectified spirit.

Fresh lard cannot always be got, and as long as simple cerate is directed to be made with white wax, an already rancid body, it happens very often that an ointment of iodide of potassium gets yellow, instead of being perfectly white. A few grains of hyposulphite of soda dissolved in a little water, added to such ointment, will have the effect of turning it snow-white.

4943. Compound Belladonna Ointment. Mix 1 drachm fresh extract of belladonna with 7 drachms of compound iodine ointment. (*See No.* 4942.) For dispersing glandular tumors, &c., which it is not desirable to mature.

4944. Ammoniacal Ointment. Melt 1 ounce each of suet and lard, in a strong wide-mouthed bottle; add 2 ounces liquor of ammonia of specific gravity .923, and close the bottle immediately. Then mix, by shaking the bottle, until the contents harden. The fat should not be heated any more than is sufficient to melt it, to prevent unnecessary loss of ammonia.

4945. Catechu Ointment for Tropical Climates. An astringent ointment may be prepared, which is not likely to become soon rancid, as is the case with ointments made with fat. Melt 4 ounces resin in ½ pint olive oil; add 1 ounce alum and 3 ounces catechu, both finely powdered.

4946. Stramonium Ointment. Mash ½ bushel of green stramonium, or jimson leaves, to a pulp (this is best done by mashing a few leaves at a time), put the pulp in an iron kettle over a slow fire. Add 2½ pounds fresh lard, and simmer to a crisp. Strain and box for use. Or: Take extract of stramonium, 1 drachm; lard, 1 ounce, and mix by trituration. This ointment is excellent for strengthening broken limbs after the bones have healed. It is also good for skin diseases, painful piles, ulcers, burns and scalds. It is probably the best ointment that can be kept in a family for general use.

4947. Mercurial or Citrine Ointment. Dissolve by gentle heat, 4 ounces mercury (quicksilver) in 70 fluid drachms nitric acid of specific gravity 1.5; add the liquid to 15 ounces lard and 32 fluid ounces olive oil; stir together, increasing the heat until the mixture froths. Keep it in air-tight earthenware or glass vessels.

4948. Mild Mercurial Ointment. This is made by mixing 1 pound mercurial ointment with 2 pounds lard.

4949. Magnetic Adeps. This is a prepared fat used for making mercurial ointment, as it will reduce 30 to 40 times its weight of quicksilver to salve. It is made by pouring melted lard, in a small stream, into cold water, placing the thin fragments thus obtained in a sieve covered with paper, or other suitable apparatus, and exposing it to the air for 3 or 4 months.

4950. Ointment of Iodide of Sulphur. Reduce 30 grains iodide of sulphur to a fine powder, rub it with a small portion taken from 1 troy ounce lard, then add the remainder of the ounce of lard, and mix them thoroughly. (*U. S. Ph.*)

4951. Ointment of Borax. This is also called *Pomade de Toscanie.* Take of borax in very fine powder, 1 drachm avoirdupois; spermaceti ointment, 1 ounce; mix by trituration. In excoriations, chaps, &c. It also forms an excellent lip-salve. A drop of neroli, or ½ drop of otto of roses, renders it more agreeable.

4952. Glycerinated Ointment of Borax. To the borax ointment, as prepared in the foregoing receipt, add 1 drachm avoirdupois pure glycerine, using a slightly warmed mortar for the mixture. This is a very effective ointment.

4953. Ointment of Creosote, or Creosote Pomade. Take of creosote, 1 fluid drachm; spermaceti ointment (*see No.* 4940), 1 ounce avoirdupois; triturate them together in a slightly warmed mortar until perfectly united, and subsequently until nearly cold. It is used as a dressing for scalds and burns, chilblains, &c. It is very useful in ringworm and some other skin diseases; also as a friction in facial neuralgia or tic-douloureux.

4954. Ointment for the Itch. The usual treatment of itch has been noticed elsewhere, and various lotions, ointments and pomades, of more or less value in its treatment, will be found under the names of their leading ingredients. Here are two additional formulæ:

4955. French Hospital Itch Ointment. Take of chloride of lime, 1 drachm avoirdupois; rectified spirit, 2 fluid drachms; rub them together, add ½ fluid ounce sweet-oil; soft-soap, 2 ounces aviordupois; oil of lemon, ½ fluid drachm; mix perfectly, and then further add common salt and sulphur, of each 1 ounce. Cheap, very effective, and much less offensive than sulphur ointment.

4956. Stavesacre Ointment. Melt together 1 ounce powdered stavesacre (staphisagria), and 3 ounces lard; digest for 3 or 4 hours, and strain. A cleanly remedy for itch, and for destroying body vermin.

4957. Ointment for Baker's Itch. Mix well together ¼ ounce ointment of nitrate of mercury (*see No.* 4947), and 1 ounce palm oil.

4958. Venice Turpentine Ointment. Venice turpentine, 2 ounces; tar, 1 ounce; butter, 4 ounces. Simmer until they are well mixed. This is very good for scald-head, ringworm, &c. First wash the head well with soap and water, and then apply the ointment.

4959. Brown Ointment. Extract of henbane, 1 drachm; yellow wax, ½ ounce; red precipitate, 2½ drachms; pure zinc, powdered, 1¼ drachms; fresh butter, 3 ounces. Melt and mix, and add 1½ drachms camphor dissolved in olive oil. This ointment is good for ringworm, all cutaneous eruptions, for ulcers, sore lips, itch, chronic ophthalmia, &c.

4960. Tar Ointment. Tar and mutton suet, equal parts; melt together, and stir till cold. This is an excellent remedy for scald-head and ringworm.

4961. Tobacco Ointment. Fresh tobacco leaves, chopped small, 1 ounce; lard, 1 pound; boil till crisp, and strain through linen. Used for ringworm, irritable ulcers, and other diseases of the skin. It should be used with caution.

4962. Salt Rheum Ointment. Mix in an earthen vessel, 1 ounce aqua-fortis, with 1 ounce quicksilver; when effervescence has ceased, incorporate with it 1 pound lard and 1 ounce dissolved hard soap; then work into the mixture 1 ounce prepared chalk and ½ table-spoonful spirits of turpentine.

4963. Magnetic Ointment. Lard, raisins cut in pieces, and fine-cut tobacco, equal weights; simmer well together, then strain and press out all from the dregs. This is an excellent ointment for salt-rheum and other skin diseases. It is also good for piles, bruises, and cuts.

4964. Basilicon Ointment. Take 10 ounces resin, 4 ounces yellow wax, and 16 ounces lard; melt them together, strain through muslin, and stir constantly until cool. This is the *resin ointment* of the U. S. Pharmacopœia. The British officinal preparation contains only 8 ounces resin, and substitutes simple ointment for the lard.

4965. Yellow Basilicon Ointment. Yellow wax, 8 ounces; burgundy pitch, 3 ounces; Venice turpentine, 4 ounces; linseed oil, 10 ounces. First melt the resin, to which add the wax and the burgundy pitch. When the whole is melted, remove from the fire, and slowly put in the oil, stirring well till it is cold. For healing cuts, abscesses, &c.

4966. Black Basilicon Ointment. Black basilicon, yellow wax, and yellow resin, 10 ounces; common pitch, 5 ounces. Melt as before, and add 10 ounces linseed oil when taken from the fire.

4967. Green Basilicon Ointment. Yellow wax and yellow resin, of each 3 ounces; Venice turpentine, 6 ounces; powdered verdigris, 1 ounce; lard, 6 ounces. Melt first the resin, &c., as before. Very efficacious in healing cuts, abscesses, and local affections of any kind.

4968. Saturnine Cerate. Powdered acetate of lead, 2 drachms; white wax, 2 ounces; olive oil, ½ pint. Melt the wax in the oil, and add gradually the acetate of lead, separately rubbed down with a portion of the oil reserved for that purpose.

4969. Hemlock Salve. Hemlock ointment, 12 ounces; spermaceti, 2 ounces; white wax, 3 ounces; melt the last two, then add them to the first, softened by a gentle heat. Used for inveterate cancerous, scrofulous, and other sores.

4970. Green Stick Salve. According to the American Dispensatory, this is prepared by taking white gum turpentine, bayberry wax, of each 2 ounces; melt together, strain, and stir till cold; adding olive oil will give it the consistence of an ointment.

4971. Black, or Healing Salve. Olive oil, 1 pint; common resin, ½ ounce; bees'-wax, ½ ounce; Venice turpentine, ½ ounce. Melt, raising the oil nearly to the boiling point; then gradually add 2 or 3 ounces powdered red lead while on the fire; do not burn it; boil slowly till it becomes a dark brown; remove from the fire, and add 1 drachm powdered camphor when it is nearly cold. This is a first-rate healing salve, superior to most; is wonderful in burns, scalds, scrofulous, fistulous, and all other ulcers. Spread on linen, and renew daily.

4972. Red Salve. Red salve, 1 pound; bees'-wax and resin, of each 2 ounces; linseed and sweet oils, of each 3 table-spoonfuls; spirits of turpentine, 1 tea-spoonful; melt all, except the first and last, together, then stir in the lead and stir until cool, adding the turpentine. Good for all inflamed sores.

4973. Green Salve. White pine turpentine and lard, ½ pound each; honey and bees'-wax, ¼ pound each; melt all together and stir in ½ ounce of very finely pulverized verdigris. This ointment cannot be surpassed when used for deep wounds. It prevents proud flesh from forming, and keeps up a healthy discharge.

4974. Green Ointment. Take prepared subacetate of copper, ½ drachm; ointment of white wax (*see No.* 4939), 7½ drachms. Triturate the subacetate of copper with the ointment until they are intimately mixed. A mild caustic, applied to venereal ulcers of the mouth and tonsils, and to the ulcerated sore throat of scarletina.

4975. Cod-Liver Oil Ointment. Melt together 1 part white wax, 1 part spermaceti, and 7 parts pale cod-liver oil. Used for ophthalmia, scrofulous sores, rheumatism, stiff joints, and some skin diseases, including ringworm. Scented with oil of nutmeg and balsam of Peru it forms an excellent pomade for strengthening and restoring the hair.

4976. Ointment for Old Sores. Red precipitate, ½ ounce; sugar of lead, ½ ounce; burnt alum, 1 ounce; white vitriol, ¼ ounce or a little less; all to be very finely pulverized; have mutton tallow made warm, ½ pound; stir all in, and stir until cool. Good.

4977. Bitter-Sweet Ointment. Bark of bitter-sweet root, 2 ounces; cover with spirits of wine, and add, unsalted butter, 8 ounces. Simmer and strain. Excellent for swelled breasts, tumors, ulcers, &c. It may be applied twice a day.

4978. Astringent Ointment. Triturate 1½ drachms powdered catechu with 2 fluid drachms boiling water; add, gradually, 1¼ ounces spermaceti ointment, continuing the trituration until the mass concretes. This is an excellent dressing for sores and ulcers, especially during hot weather.

4979. Neuralgia Ointment. Take 2 drachms each of cyanide of potassium, and chloroform, and make into a salve with 1 ounce lard, for external application.

4980. Ointment of Lead. Take of olive oil, ½ pint; white wax, 2 ounces; sugar of lead, 3 drachms. Let the sugar of lead, reduced to a fine powder, be rubbed with some of the oil, and added to the other ingredients, previously melted together, stirring them till quite cold. This cooling astringent ointment may be used in all cases where the intention is to dry and skin over the part, in scalding, &c.

4981. Zinc Ointment. Mix 1 ounce oxide of zinc and 6 ounces lard. This is astringent, desiccative, and stimulant; an excellent and useful application for burns, excoriations, and skin diseases attended by discharges.

4982. Chloroform Ointment for Neuralgic Pains. Mix 1 drachm chloroform with 1 ounce spermaceti ointment. (*See No.* 4933.) This should be kept in a wide-mouthed, stoppered phial.

4983. Belladonna Anodyne Ointment. Mix 3 drachms fresh and good extract of belladonna, ½ drachm powdered opium, and 3 drachms lard. For neuralgia, &c., apply with friction for 6 to 8 minutes.

4984. Aconitine Ointment. Aconitine, 16 grains; alcohol, 12 drops; olive oil, ½ drachm; lard, 1 ounce. Rub the aconitine with the spirit, then add the oil by drops, and, after it is thoroughly mixed, pour in the lard rendered nearly liquid by heat; stir well until cold. A small portion is applied by the tips of the fingers and gentle friction, in neuralgic and rheumatic affections, &c.

4985. Ointment for Sore Nipples. Glycerine, rose-water, and tannin, equal weights, rubbed together into an ointment, is very highly recommended for sore or cracked nipples.

4986. Tannin Ointment for Piles. Tannin, 2 drachms; water, 2 fluid drachms; triturate together, and add lard, 1½ drachms. An excellent application for piles.

4987. Spackman's Pile Ointment. Mix together 1½ ounces carbonate of lead; 6 grains sulphate of morphia; 1 ounce stramonium ointment (*see No.* 4946); and sufficient olive oil to make into a salve.

4988. Ointment for Piles. Triturate 8 grains morphia in 1 ounce melted spermaceti ointment (*see No.* 4940), until the morphia is dissolved; then add 1½ drachms of galls in impalpable powder, 12 to 15 drops essential oil of almonds, and stir until the mass is cool.

4989. Pile Salve. Take 1 scruple powdered opium, 2 scruples flour of sulphur, and 1 ounce of simple cerate. (*See No.* 4932.) Keep the affected parts well anointed. Be prudent in your diet.

4990. Salve for Sore Breasts. Take 1 pound tobacco, 1 pound spikenard, ½ pound of cumfrey, and boil them in 3 quarts chamber-lye till almost dry; squeeze out the juice, add to it pitch and bees'-wax, and simmer it over a moderate heat to the consistence of salve. Apply it to the part affected.

4991. Iodide of Lead Ointment. An ointment of iodide of lead composed of 4 parts iodide of lead, 4 parts chloride of ammonium, and 50 of lard, is either of a yellow or white color, according to the manner in which these ingredients are brought together. When rubbed together dry, the color of the mixture is yellow; but when the chloride of ammonium, in order to facilitate the mixing, is first liquefied in a small quantity of water before being added to the iodide of lead, the yellow color of the latter disappears, owing to the formation of two colorless salts, the chloride of lead and iodide of ammonium. It is well in cases like these to adhere strictly to the directions of the prescription. (*Eymael.*)

4992. Ingall's Iodoform Ointment. Dissolve ½ drachm iodoform in sufficient rectified alcohol, and make into an ointment with 7½ drachms lard. Iodoform is extensively and successfully used in the treatment of syphilitic ulcers and rupia. The above formula is the one adopted by Dr. Ingalls, attending surgeon of the Boston city hospital.

4993. Carbolic Cerate. Melt together 5 ounces lard, and 2½ ounces white wax; add ½ ounce balsam of fir, and when it begins to cool, stir in ½ ounce carbolic acid. The addition of balsam fir to this preparation corrects the disagreeable odor of the acid, and renders it slightly adhesive, which is quite desirable when used as a dressing for burns, old sores, &c. (*See No.* 4996.)

4994. Ointment of Tannate of Manganese. Mix 3 grains tannate of manganese with 1 troy ounce cold cream. (*See No.* 1125.) This is a good application for bad wounds.

4995. Tartar Emetic Ointment. Take 2 drachms potassio-tartrate of antimony, and rub it well into 1 ounce lard. This will produce an eruption on the skin very similar to small-pox in appearance.

4996. Carbolic Salve. There are different formulæ recommended for this salve, containing different amounts of carbolic acid; the character of the disease will determine which to use. The carbolic acid employed is the crystallized article, sold in bottles, and taken out by warming the latter in hot water, or the fluid resulting from the crystals, which are melted in warm weather, or are dissolved by absorbing a little water, when the bottles are not perfectly stoppered.

I. Take carbolic acid, ½ fluid drachm, and lard, 1 ounce. Triturate together in a porcelain mortar.

II. Take carbolic acid, 1 fluid drachm, and lard, 3 ounces. Melt the lard at a gentle heat, add the carbolic acid, and triturate until the mixture is cold.

III. Take carbolic acid, 1 fluid drachm, and ointment of white wax (*see No.* 4939), 7 drachms. Prepare as No. II. (*See No.* 4993.)

4997. Cerate of Savine. Moisten 3 troy ounces savine in fine powder with ether; pack it firmly in a cylindrical percolator, and displace with ether until the percolate passes nearly colorless. Evaporate spontaneously to the consistence of syrup, add it to 12 troy ounces resin cerate softened by a gentle heat, and mix thoroughly.

4998. Sulphur Ointment. Mix together 1 ounce sublimed sulphur and 2 ounces lard.

4999. Itch Ointment. Washed sulphur, 1½ ounces; chloride of lime, 2 drachms; hog's lard, 4 ounces. Mix and make into an ointment.

5000. Cucumber Ointment. Take of oil of sweet almonds, 7 fluid ounces; spermaceti, 18 drachms; white wax, 5 drachms; glycerine, 1 fluid ounce; green cucumbers, 4 pounds. Cut the cucumbers in small pieces, mash them in a wedgwood mortar, let them macerate in their own liquor for 12 hours, express and strain; melt the almond oil, spermaceti, and wax together, by means of a water-bath; add to it the strained liquor, stirring constantly so as to incorporate the whole together. Set aside in a cool place (an ice-chest preferred) till it becomes hard, then beat with a wooden spoon, so as to separate the watery portion of the cucumbers from the ointment; pour off the liquor thus obtained, and mix the glycerine with the ointment without the aid of heat, by working it with the hands until it becomes thoroughly incorporated. Put up in 4-ounce jars, cover with a layer of rose-water, and set aside in a cool place.

5001. Foot-Rot Ointment. Lard and Venice turpentine, 4 ounces of each; melt and add 1 ounce blue vitriol. Good for cows or sheep.

5002. Cracked Hoof Ointment. Tar and tallow, equal parts melted together.

5003. Compound Resin Cerate. Melt together 12 troy ounces each of resin, suet, and yellow wax; 6 troy ounces turpentine, and 7 troy ounces flax-seed oil. Strain through muslin, and stir constantly till cool. (*U. S. Ph.*) This preparation, also known as *Deshler's Salve*, should be kept well protected from the air, as it is liable to become tough by exposure. (*U. S. Dis.*)

5004. Egyptiacum Salve. Take 1½ ounces verdigris, 1½ ounces alum, ½ ounce sulphate of copper, ⅛ ounce corrosive sublimate, all in powder; boil over a slow fire with 2½ ounces vinegar and ½ pound honey until of a proper consistence. Stir up well before using.

5005. Egyptian Ointment. A detergent application for foul ulcers, &c. Mix by heat and agitation, 10 parts verdigris, 1 part calcined alum, 14 parts strong vinegar, and 32 parts thick purified honey.

5006. Compound Gall Ointment. Rub together 6 drachms very finely powdered gall-nuts, 1½ drachms powdered opium, and 6 ounces lard.

5007. German Black Salve. Lard, 24 parts; white oxide of zinc and Peruvian balsam, of each 3 parts; nitrate of silver, finely pulverized, 1 part. This formula is taken from the Hamburg Pharmacopœia.

5008. To Keep Ointment from Becoming Rancid. About 2 per cent. of finely powdered gum benzoin, or a less quantity of benzoic acid dissolved in the fatty matter by heat, will greatly retard, if not wholly prevent, the ointment from turning rancid.

5009. Schacht's Glycerine of Starch, or Plasma. The use of fatty matter as the vehicle for drugs in preparing ointments and cerates is sometimes open to objection. The remedies introduced are frequently insoluble in fat, which consequently acts to a certain extent in defending the skin from, instead of facilitating the perfect action of the remedy. Aqueous remedies are difficult to mix with fat without soap or some otherwise needless addition. Another strong objection is the tendency of fatty matter to become rancid in contact with the skin. Mr. G. F. Schacht proposes a substitute consisting of 1 fluid ounce pure glycerine and 70 grains starch powder. These are mixed while cold, and then gradually heated to about 240° Fahr., constantly stirring; he gives this preparation the name of *plasma*. This constitutes a basis whose consistence is good, and does not vary with changes of temperature; it is soluble in water, and may consequently be removed from tender surfaces with the greatest ease; it dissolves and thoroughly mingles with all materials that are soluble in water, and therefore presents such remedies in the condition most favorable for absorption; and, lastly, it is not liable to rancidity. With plasma substituted for fat, may be produced preparations corresponding to most of the cerates and ointments of the Pharmacopœia, but free from the special objections before alluded to. The plasma should be kept in a closely corked bottle. The following plasmas are proposed by Mr. Schacht as improvements on the corresponding ointments of the Pharmacopœia.

5010. Schacht's Cantharides Plasma. Evaporate the decoction of Spanish flies to an extract, and mix with the plasma, using the same proportions as laid down for cantharides ointment. (*See No.* 5017.)

5011. Schacht's Mercurial Plasma. Mix 14 drachms starch with 6 fluid ounces glycerine, gradually adding 12 ounces mercury, and stirring till the globules disappear. Then add 6 fluid ounces glycerine, and heat to 240° Fahr., constantly stirring.

5012. Schacht's Glycerinated Nitrate of Mercury. Take 1 drachm terbasic nitrate of mercury, and 1 ounce plasma.

5013. Schacht's Glycerinated Iodide of Potassium. Dissolve 2 drachms iodide of potassium in 2 fluid ounces glycerine; add 140 grains starch, and heat to 240° Fahr.

5014. Schacht's Glycerinated Petroleum. Rub 1 drachm petroleum with 70 grains starch until quite smooth, then add gradually 1 fluid ounce glycerine.

5015. Glycerinated Iodine. This is recommended for loss of voice, and is composed of 16 grains of iodine in 1 ounce inodorous glycerine. The addition of starch to this is not advisable, as it would convert the iodine into iodide of starch.

5016. Narcotic Glycerole, for external use, applied on lint. Take 1 part aqueous extract of opium, 4 parts extract of belladonna, and 60 parts glycerine.

5017. Cantharides Ointment. Infuse for 12 hours 1 ounce avoirdupois of cantharides in 6 imperial fluid ounces olive oil in a covered vessel. Place the vessel in boiling water for 15 minutes, press through muslin, and add 1 ounce melted yellow wax, stirring constantly till cool. (*Br. Ph.*)

Poultices.

External applications, used to promote suppuration, allay pain and inflammation, resolve tumors, &c. They are generally prepared with substances capable of absorbing much water, and assuming a pulpy consistence, so as to admit of their application to any surface, however irregular. Their curative action principally depends on the liquids with which they are moistened, and the heat retained by the mass. The addition of a little lard, olive oil, or, still better, glycerine, to a poultice, promotes emollient action and retards hardening. A fold or two of lint dipped in hot water, either simple or medicated, and covered with a thin sheet of gutta-percha, or India-rubber cloth, to prevent evaporation, may often be conveniently employed instead of a poultice. Spongio-piline (*see No.* 5039) is still better for this purpose than lint. The following are the principal poultices, but others may be found by referring to the Index.

5019. Bread Poultice. Take stale bread in crumbs, pour boiling water over it, and boil till soft, stirring it well; then take it from the fire, and gradually stir in a little glycerine or sweet oil, so as to render the poultice pliable when applied.

5020. Slippery Elm Poultice. Take a sufficient quantity of pulverized slippery elm bark; stir it in hot or warm milk and water, to the consistence of a poultice. This is a most efficacious poultice; is of almost universal application, and removes inflammation sooner than any other. If tincture of myrrh be added, it is valuable in boils, ulcers, carbuncles, &c.

5021. Mustard Poultice. Take equal parts of ground mustard and ground flax-seed, and mix them thoroughly together, with barely enough of water to make them of the thickness of common paste. To prevent sticking, a little glycerine or sweet oil is to be added. The addition of bread crumbs serves to diminish, that of a little vinegar to increase the irritating power of the mustard.

5022. Strong Mustard Poultice. Mix the best English ground mustard with strong vinegar; spread it on a piece of book or tarleton muslin, to prevent its adhesion to the skin. Wet the part first with vinegar, and apply the poultice.

5023. Linseed Poultice. Take of linseed, powdered, 4 ounces; hot water, ½ pint. Gradually sprinkle the powder into, and stir well with a spoon. This is good and convenient for many cases. It is preferable to the bread and milk poultice so much in use, as it is not so liable to become brittle and hard when dry. It is very useful in carbuncle, obstinate inflammation, &c.

5024. Carrot Poultice. Take of boiled carrots, bruised, 1 pound; flour, 1 ounce; butter, ½ ounce. Mix them with a sufficient quantity of hot water to form a pulp. This will be found a valuable application in ulcerated sores and swellings, scrofulous sores of an irritable kind, and many other inveterate ulcers.

5025. Poultice for Sprains and Bruises. Carbonate ammonia, 2 ounces; vinegar, 2 pints; proof spirits, 3 pints. Mix the ammonia and vinegar; when the effervescence ceases, add the spirit. For inflammation of the joints, of some standing, mix with aniseed meal, and use as a poultice twice a day. It is also valuable for sprains, bruises, and other injuries.

5026. Charcoal Poultice. Linseed meal, ½ pound; charcoal powder, 2 ounces; hot water, sufficient to give it the necessary consistence. Or: Soak 2 ounces bread in ½ pint boiling water; add to this, by degrees, 10 drachms linseed meal; and, afterwards, 2 drachms powdered fresh charcoal; then sprinkle 1 drachm powdered charcoal on the surface of the poultice. This poultice is highly antiseptic; that is to say, it has great power in cleansing ulcers and correcting a tendency to mortification. The power is derived from the charcoal, which is remarkable for its purifying energy. It should be frequently renewed. Dr. Bird, in his work on the medical uses of charcoal, gives numerous proofs of the efficacy of this application. Besides purifying and healing, it conteracts the offensive smell arising from putrid sores.

5027. Yeast Poultice. Take of milk, blood-warm, 1 pint; yeast, 1 gill. Stir in fine slippery elm bark, to form a poultice. This is a good antiseptic and refrigerant poultice. Applied to gangrenous ulcers, it is more efficacious than any others; it sooner arrests mortification, used with proper auxiliaries. It is also very serviceable in other species of inflammation.

5028. Indian Turnip Poultice. Take of the tops and roots of Indian turnip, if green; if dry, the roots only; simmer in water, and add slippery elm bark sufficient to form a poultice. This poultice is used in the treatment of scrofula with the best effect. It is superior to every other poultice in scrofula, in a state of swelling and inflammation.

5029. Potato Poultice. Boil the common potato, mash or bruise soft, and then stir in finely pulverized slippery elm bark. This poultice has been used with success in ophthalmia (inflammation of the eyes) of an acute character, when other means have failed.

5030. Goulard's Poultice. It is thus made: Take 1½ drachms extract of lead (solution of acetate of lead); rectified spirit of wine, 2 ounces; water, 12 ounces; bread-crumb, sufficient to make the whole into a proper consistence. This poultice is an excellent application to reduce swelling and inflammation, and to allay irritation.

5031. Lobelia Poultice. Linseed meal, ½ ounce; slippery elm, 1 ounce; powdered lobelia, 1½ ounces; ginger, 1 ounce; whiskey sufficient to make it. Good for all inflamed parts, as the side in pleurisy, liver complaints, rheumatism, lumbago.

5032. Poultice for a Fester. Boil bread in lees of strong beer; apply the poultice in the general manner. This has saved many a limb from amputation.

5033. Alum Poultice. Take of alum, in fine powder, 1 drachm avoirdupois, and the white of 2 eggs; shake them together until they coagulate. Formerly much used in broken chilblains, chaps, sore nipples, chronic inflammation of the eyes, &c., applied on linen, and covered with a piece of fine muslin.

5034. Hemlock Poultice. Make a poultice of 4½ ounces linseed meal in ½ pint boiling water; spread on its surface 1 ounce extract of hemlock softened with a little hot water. This is an anodyne application for irritable and painful cancerous, scrofulous, and syphilitic sores, tumors, &c.

5035. Gout Poultice. Dissolve 6 drachms balm of Mecca in 16 ounces rectified spirit; next digest for 48 hours, 1 ounce each of red cinchona bark, sarsaparilla, and sage, and ½ ounce saffron, in 32 ounces rectified spirits; filter this, mix it with the solution of balm of Mecca, and add twice their weight of lime-water. Sprinkle 2 fluid ounces on the surface of a hot linseed meal poultice, large enough to surround the affected part.

5036. Soap Poultice. Dissolve 1 ounce scraped or sliced white soap in ½ pint boiling water, and mix with sufficient bread to make a poultice. This is good for scalds and burns.

5037. Vinegar Poultice. Soak bread in vinegar and apply cold; for bruises, extravasations, black-eyes, &c.

5038. Chlorinated Poultice. Mix gradually 4½ ounces linseed meal with 6 fluid ounces boiling water; add 2 fluid ounces of a solution of chlorinated soda (chloride of sodium), applied to foul ulcers, &c.

5039. Spongio-piline. This is the name of a very ingenious contrivance, recently introduced abroad, which may be used either as a poultice or as a means of fomentation. It consists of wool and small particles of sponge, apparently felted together, and attached to a skin of India-rubber. It is about half an inch in thickness. It will be found of great value and convenience for either of the purposes referred to. It retains heat for a considerable time, and vinegar, laudanum, camphor, hartshorn, etc., can be, by its means, placed on the skin, accompanied by heat and moisture, much more readily, and with greater cleanliness, than by means of ordinary poultices.

Plasters.

External applications that possess sufficient consistence not to adhere to the fingers when cold, but which become soft and adhesive at the temperature of the human body. Plasters are chiefly composed of unctuous substances united to metallic oxides, or to powders, wax, or resin. They are usually formed whilst warm, into ½ pound rolls about 8 or 9 inches long, and wrapped in paper. When required for use, a little is melted off the roll by means of a heated iron spatula, and spread upon leather, linen, or silk. The less adhesive plasters, when spread, are usually surrounded with a margin of resin plaster, to cause them to adhere. In the preparation of plasters, the heat of a water-bath, or steam, should be alone employed.

5041. To Spread Plasters. In spreading plasters convenience requires and neatness demands an uncoated marginal edge. This is usually secured by pasting strips of paper along the edges of the skin or other material used, and removing them after the spreading of the plaster is affected. It is just here that a practical difficulty frequently arises. The paper edges are liable, from drying of the paste, to adhere so strongly that either paper or skin will give way upon an attempt at their removal; the application of water will then be necessary to soften the attachment, and the final results may be expected to present a daubed and uncleanly aspect. This difficulty may be entirely avoided by applying to the paste brush a little glycerine before the adjustment of the marginal strips. (*Ebert*).

5042. To Prevent Plasters from Adhering to Paper. It is recommended to dust the latter over with powdered French chalk. If a piece of thin paper, moistened with olive oil and then wiped dry, be laid over a plaster, it will prevent adhesion to the wrapping paper.

5043. Litharge, Lead, or Diachylon Plaster. Take 5 pounds litharge in very fine powder, 1 gallon olive oil, and 1 quart water. Or: 5 ounces litharge, 12 fluid ounces olive oil, and 8 fluid ounces water. Unless the oil is fully 2¼ times the weight of the litharge, the plaster soon gets hard and non-adhesive. Put the water and litharge into a perfectly clean and well polished tinned copper or copper pan, mix them together with a spatula, add the oil, and boil, stirring constantly until the plaster is sufficiently hard when thoroughly cold. This process usually occupies from 4 to 5 hours. The operation may be completed in from 20 to 30 minutes by adding to the litharge and water ¼ pint colorless vinegar, for each pound of litharge employed, previous to adding the oil.

5044. Mahy's White Lead Plaster. Boil together 1 pound pure carbonate of lead, 32 fluid ounces olive oil, and sufficient water, constantly stirring until perfectly incorporated; then add 4 ounces yellow wax, and 1½ pounds lead plaster; when these are melted, and the mass somewhat cooled, stir in 9 ounces powdered orris root. This is an application much used for inflamed and excoriated surfaces, bed-sores, burns, &c.

5045. **Deschamp's Plaster.** Fasten a piece of fine muslin, linen, or silk, to a flat board; give it a thin coating of smooth, strained flour paste. When dry, apply 2 coats of colorless gelatine, made into size with warm water. This is said to be superior to the ordinary court plaster.

5046. **Adhesive Resin Plaster.** Resin plaster, spread upon muslin, forms the well-known *Strapping* or adhesive plaster, so extensively used for protecting raw surfaces, supporting parts, dressing ulcers, retaining the lips of recent cuts and wounds in contact, &c. It is gently stimulant, and is thought to assist the healing process; it is also employed as a basis for other plasters. Mix by a moderate heat, 1 ounce resin with 5 ounces litharge plaster. (*See No.* 5043.) Or: 4 ounces resin, and 2 ounces powdered castile soap, with 2 pounds litharge plaster.

5047. **Cancer Plaster.** White oak-bark, 4 ounces; bruise it well, and add urine sufficient to cover it. Infuse four days, boil it till it becomes as thick as molasses. Add 2 ounces honey and 2 ounces strained turpentine gum. To make this plaster caustic, add 2 drachms white vitriol. Spread on soft leather or linen. It may be applied to all kinds of ulcers and white swellings. For cancers it is invaluable.

5048. **Anodyne Plaster.** Melt an ounce of adhesive plaster, or diachylon (*see No.* 5043), and, whilst cooling, add a drachm of powdered opium, and the same quantity of camphor, previously dissolved in a small quantity of olive oil. Spread on leather. This soon relieves an acute local pain. Or: Powdered opium, ½ ounce; resin of the spruce fir, powdered, 3 ounces; lead plaster, 1 pound. Melt the plaster and resin together, then add the opium and mix the whole. Useful for rheumatic pains.

5049. **Strengthening Plaster.** Litharge plaster, 24 parts; white resin, 6 parts; yellow wax and olive oil, of each 3 parts; red oxide of iron, 8 parts. Let the oxide be rubbed with the oil, the other ingredients added, melted, and mix the whole well together. This is an excellent plaster for relaxation of the muscles and weakness of the joints arising from sprains and bruises. The plaster spread over leather should be cut into strips 2 inches wide, and strapped firmly round the joints.

5050. **Cough Plaster.** Castile soap, 1 ounce; lead plaster, 2 drachms; sal-ammoniac, 1 drachm. Melt the soap and lead plaster together, and add the ammoniac when the mixture is nearly cold. This plaster must be applied to the chest immediately after it is spread, and must be renewed every 24 hours. It is often of great service in whooping-cough and coughs of an asthmatic character.

5051. **Resolvent Plaster.** Purified ammoniac, 1 pound; purified mercury, 3 ounces; sulphuretted oil, 1 fluid drachm. The mercury must be rubbed with the sulphuretted oil till the globules disappear, and the ammoniac, previously melted, added gradually, and the whole mixed together. This plaster has great efficacy in promoting the absorption of glandular swellings and indolent tumors. It is of much use also as an application to corns and bunions. It can be obtained from the apothecary, and is usually known as the plaster of ammoniac and mercury.

5052. **Burgundy Pitch Plaster.** Melt together 2 pounds strained burgundy pitch, 1 pound prepared frankincense, and 4 ounces each yellow resin and bees'-wax; add 2 fluid ounces each olive oil and water, and 1 ounce expressed oil of nutmeg; stir constantly until evaporated to a proper consistence.

5053. **Blister or Cantharides Plaster.** Melt together 7½ ounces each yellow wax and suet; 6 ounces lard, and 3 ounces resin; when mixed, remove from the fire, and, a little before they concrete, sprinkle in and mix thoroughly 1 pound very finely powdered cantharides.

5054. **Strong Blistering, or Cantharides Plaster.** Mix at a heat below 212° Fahr., 4½ ounces Venice turpentine, 3 ounces each of burgundy pitch and cantharides, 1 ounce bees'-wax, ½ ounce finely powdered verdigris, and 2 drachms each of powdered mustard and black pepper.

5055. **Warm Plaster.** For this plaster, take 1 part of blistering plaster, and of burgundy pitch 14 parts; mix them by means of a moderate heat. This plaster is stimulant, slightly irritating the skin, and is of use in ordinary coughs and whooping-cough, sciatica, and other local pains.

5056. **Homœopathic Mustard Plaster.** For chronic inflammation, colds, sore throats, inflammations of the lungs, liver, and bowels, sprains, &c. Take 1 part by measure of mustard; 5 parts flour; and 5 of Indian meal. Mix the mustard in a little hot water, and, when smooth, add about 2 parts boiling water, and when all is dissolved stir in the flour, and then the meal, thoroughly; adding more boiling water if necessary. Spread on a thick cloth double folded, to retain heat and moisture. Cover with mosquito netting, or lace, and nothing closer, sew around the edges, apply to the painful spot; fasten with bandages, and wear till dry, or for 24 hours, and then put on a fresh one. Continue to renew these for 1 or 2 weeks. When the skin becomes too tender, add 1 more spoonful of flour and meal each. When these plasters can no longer be borne, use powdered ginger instead of mustard, and then finish with plain Indian meal poultice alone. (*Leggett.*)

5057. **The Best Mustard Plaster.** Take a piece of waste linen, and, if crumpled, iron it smooth; or paper will do. Procure a small quantity of black mustard seed, and bruise it to a coarse powder, in a pestle and mortar or otherwise. Spread over the linen a thin solution of gum, and sprinkle the powder equally over it. Dry in a warm place. When wanted, plasters may be cut of any size or shape; and when applied should be momentarily dipped in tepid water, and tied over the affected part with a bandage. These plasters are more simple, cleanly, and effective than the ordinary mustard poultices. This preparation may be had at the drug stores, made in 3 different strengths, No. 1 being the most powerful.

5058. Court Plaster. This plaster is merely a kind of varnished silk, and its manufacture is very easy. Bruise a sufficient quantity of isinglass, and let it soak in a little warm water for 24 hours; expose it to heat over the fire till the greater part of the water is dissipated, and supply its place by proof spirits of wine, which will combine with the isinglass. Strain the whole through a piece of open linen, taking care that the consistence of the mixture shall be such that, when cool, it may form a trembling jelly. Extend a piece of black or flesh-colored silk on a wooden frame, and fix it in that position by means of tacks or twine. Then apply the isinglass (after it has been rendered liquid by a gentle heat) to the silk with a brush of fine hair (badgers' is the best). As soon as this first coating is dried, which will not be long, apply a second; and afterwards, if the article is to be very superior, a third. When the whole is dry, cover it with two or three coatings of the balsam of Peru. This is the genuine court plaster. It is pliable, and never breaks, which is far from being the case with spurious articles sold under that name.

5059. De Rheims' Healing Paper. Make a strong tincture of capsicum-pods by steeping them for several days, in a warm place, in twice their weight of rectified spirits of wine. Dissolve gum-arabic in water to about the consistency of molasses. Add to this an equal quantity of the tincture, stirring it together with a small brush or a large camel's-hair pencil, until they are well incorporated. The mixture will be cloudy and opaque. Take sheets of silk or tissue-paper; give them with the brush a coat of the mixture; let them dry, and then give another; let that dry, and, if the surface is shining, there is enough of the peppered gum; if not, give a third coat. This paper, applied in the same way as court plaster to chilblains that are not broken, and burns that are not blistered, speedily relieves the itching and the pain. It acts like a charm, and effects a rapid cure. The same with cuts and discolored bruises. It likewise allays rheumatic pains in the joints. Its great value is that, besides acting as ordinary sticking-plaster, it abates suffering and hastens the process of healing.

5060. Cooley's Corn Plaster. In a piece of card, cut a round hole the size of the central portion of the corn; lay the card on a piece of adhesive plaster, and warm the spot of plaster exposed by the hole in the card, by holding a hot iron near it for a second or two; then remove the card and sprinkle some finely powdered nitrate of silver on the warm spot of the plaster. When cold, shake off the loose powder, and apply to the corn. Two or three applications seldom fail to cure.

5061. Carbolic Plaster. Carbolic glycerine, 34 parts by weight; prepared chalk, 94 parts. Mix well by kneading, and enclose in closely-stoppered jars.

5062. Irritating Plaster. Boil together 1 pound tar, ½ ounce burgundy pitch, 1 ounce white pine turpentine, and 2 ounces resin. Finely powder 1 ounce each mandrake root, blood root, poke root, and Indian turnip. Stir these into the melted tar, &c., before it cools. This plaster, spread on muslin and renewed daily, will raise a sore, which is to be wiped with a dry cloth, to remove matter, &c. The sore must not be wetted. This is a powerful counter-irritant, for removing internal pains, and in other cases where an irritating plaster is necessary.

Gargles are simple remedies well adapted to domestic practice in sore throats of various kinds. According to the nature of the ingredients of which they are made, they allay irritation and inflammation, invigorate the membrane lining the mouth and throat, and promote suppuration. The particular purpose for which they are required ought to be kept in view in their preparation.

5064. Potassa Gargle for Sore Throat. Strong sage tea, 1 pint; strained honey, 2 table-spoonfuls; chlorate of potassa, 1 tea-spoonful; mix and use as often as necessary, being careful to shake before using. Also poultice the throat with hops and warm vinegar. Brewers' yeast substituted for the chlorate of potassa makes a very effectual gargle.

5065. Gargle for Sore Throat. Very strong sage tea, ½ pint; strained honey, common salt, and strong vinegar, of each 2 table-spoonfuls; cayenne (pulverized), 1 rounding tea-spoonful; steeping the cayenne with the sage, strain, mix, and bottle for use, gargling from four to a dozen times daily, according to the severity of the case.

5066. Carbolic Acid Gargle. Used as a gargle for sore throat, attended with foul breath. Take 2 grains of the crystals to 1 ounce of water.

5067. Gargle for Ulcerated Sore Throat. Water, ½ pint; decoction of Peruvian bark, ½ pint: sulphate of zinc, 1 drachm. Mix.

5068. Gargle for Inflammation of the Throat. Purified nitre, 2 drachms; barley water, 7 ounces; acetate of honey, 7 drachms; mix the ingredients. To be used frequently.

5069. Gargle for General Domestic Use in Sore Throat. Take 3 tea-spoonfuls vinegar, 2 tea-spoonfuls tincture of myrrh, 2 of honey, a glass of port wine, and 3 or 4 wine-glasses of warm water; mix all these ingredients, and the gargle is ready for use. A decoction of the leaves of the black currant may, with good effect, be added instead of the warm water. This makes both a pleasant and most useful gargle.

5070. Mucilaginous Gargle for Inflamed Throat. Tincture of myrrh, 3 drachms; mucilage of gum-arabic, 7 ounces. Mix. This gargle is of use in defending the parts when the saliva is of an acrid character.

5071. Gargle for Threatened Mortification of the Throat. Tincture of capsicum, 6 drachms; honey of roses, 3 drachms; infusion of roses, ½ pint. Mix. Or: Tincture of capsicum, 6 drachms; infusion of Peruvian bark, 5 ounces; port wine, 3 ounces. Mix.

5072. Gargle to Promote Suppuration. Barley water and infusion of linseed. This gargle is to be used warm. It must be kept in view that this mild gargle acts by softening the parts of the throat, and hastening the suppuration by its heat; and it is requisite, therefore, that the temperature of the gargle be kept up.

5073. Carbolized Gargle for Diphtheria, Tonsilitis, &c. Carbolic acid, 20 minims; acetic acid, ½ drachm; honey, 2 fluid ounces; tincture of myrrh, 2 fluid drachms; water, 6 fluid ounces. The carbolic and acetic acids to be well shaken together before the other ingredients are added. *(Charles Sedgwick.)*

Caustics. Subtances that corrode or destroy the texture of the skin and organized bodies. Their action is commonly called burning. The principal caustics employed by surgeons are nitrate of silver, caustic potassa, sulphate of copper, red oxide of mercury, and the nitric and acetic acids.

5075. Vegetable Caustic. Burn oak or beech wood to ashes. Make a lye from them, and simmer it till it becomes rather thicker than cream; the evaporation may be continued in the sun. Spread on leather when used. It is valuable in cancers, fistulas, scrofulous and indolent ulcers, where there is proud flesh.

5076. Medicated Lint. Dissolve 20 to 30 grains nitrate of silver in 1 fluid ounce distilled water; saturate ½ ounce of dry lint with the solution, and expose it in a saucer to the light and air until it becomes black and dry.

5077. Iodine Paint; Iodine Caustic. Take of iodide of potassium, ½ ounce avoirdupois; iodine, ¼ ounce; proof-spirit, 3 ounces; dissolve by agitation. Used as a paint in cases in which it is desired to apply iodine, in a strong form, locally; also as a caustic for corns, warts, &c. *(Soubeiran.)* The tincture of iodine of the Pharmacopœia is, however, more generally employed; but it is only of about one-third the strength of the above.

5078. To Prevent Iodine from Staining. By adding a few drops of liquid carbolic acid to the iodine tincture, the latter will not stain. According to Dr. Bogs, of the Indian Service, carbolic acid also renders the efficacy of tincture of iodine more certain. He recommends the following formula, whenever injections of the latter are indicated: Alcoholic tincture of iodine, 45 drops; pure liquid carbolic acid, 6 drops; glycerine, 1 ounce; distilled water, 5 ounces. In blennorrhœa and leucorrhœa, this mixture is said to be superior to tar-water.

5079. Caustic for Corns. Take of liquid terchloride of antimony and tincture of iodine, of each 2 drachms avoirdupois; protiodide of iron, 7 grains; mix, and preserve it in a well-stoppered phial. Applied, with care. Two to four applications are said to effect a cure.

5080. Convenient Vehicle for the Application of Nitrate of Silver. At University College Hospital (London) they have adopted the plan of dissolving nitrate of silver in nitrous ether; it can then be spread with a camel's-hair brush over a surface, and the ether immediately evaporates.

Rubefacients. Substances or agents, which, when applied for a certain time to the skin, occasion a redness and increase of heat without blistering. They act as counter-irritants. Mustard or powdered ginger, made into a paste with water, hartshorn and oil, and ether or alcohol (when their evaporation is prevented), are among this class of remedies.

5082. Counter-Irritants. Substances applied to the surface of the body to establish a secondary morbid action, with the view of relieving one already existing. Those best known are blisters, mustard poultices, hartshorn and oil, and liniment of ammonia.

5083. Blistering Tissue. These blistering compositions are superior to the common cantharides blisters, from their greater cleanliness, efficiency, and ease of application, and their being less liable to produce excessive irritation.

5084. Strong Blistering Tissue. Powdered cantharides is exhausted with sulphuric ether by percolation (*see No.* 41), and the resulting tincture reduced to the consistence of molasses by distillation; the extract is then mixed with twice its weight of yellow wax, melted by a very gentle heat, and spread on waxed cloth.

5085. Blistering Tissue. Digest 3 drachms powdered cantharides in 1 ounce ether for a day or two; decant and add 4 drachms sandarach, 2 drachms mastic, ½ drachm turpentine, and 10 or 12 drops oil of lavender; mix and spread as above.

5086. Blistering Tissue. Mix 2 parts acetic extract of cantharides, and 1 part each of resin cerate and bees'-wax; use as before.

5087. Blistering Plaster. Infuse 3 drachms powdered cantharides in 4 ounces acetic ether for 8 days; decant and evaporate as in No. 5084; then add 4 drachms resin, and spread on court plaster.

5088. Management of Blisters. Spread the plaster thinly on paper, or linen, and rub over it a few drops of olive oil. In this way the blister acts speedily, and with less irritation than usual.

5089. To Camphorate Blisters. M. Deschamps d'Avallon has suggested, when it is desirable to camphorate a blister, it may be readily accomplished by dropping on its surface a few drops of a saturated solution of camphor in chloroform, made by adding 2 parts of the latter to 4 of the former.

Balsams. Balsams are semi-liquid resinous substances, having for the most part the consistence of honey. Some, however, are solid, and the greater number harden by exposure to the air and age. They are generally aromatic, soluble in alcohol, partly soluble in ether, and not at all so in water. Their usual constituents are resin and benzoic acid, mixed with a large portion of aromatic essential oil. Some of the substances falsely called balsams contain no benzoic acid, as the balsam of copaiba, &c.; and many preparations, from the presumption that they possess balsamic qualities, have also received this name.

5091. Friar's Balsam, or Jesuit's Drops. Take gum benzoin, 6 ounces; strained storax, 2 ounces; pulverized aloes and myrrh, each ½ ounce; balsam Peru, 1 ounce; balsam tolu, 2 ounces; extract of liquorice, 2 ounces; alcohol, 2 quarts. Let it stand for 2 weeks, with occasional agitation, and filter the whole through paper. A good application for wounds and cuts; and as such was very effectual in the hands of the old friars. Internally, it is stimulant, expectorant, and anti-spasmodic, and is useful in asthma, catarrh, consumption, and languid circulation. Dose, ½ a drachm on loaf sugar.

5092. Balsam of Horehound. Dissolve 2 ounces each extract of horehound and extract of liquorice, in ½ pint hot water; when cold, add ¾ pint paregoric, 6 ounces oxymel of squills, 2 ounces tincture of benzoin, and 10 ounces honey. Mix well and strain through flannel. Dose for an adult, ½ to 1½ tea-spoonfuls, accompanied by a dose or two of aperient medicine.

5093. Balsam of Honey. Balsam of tolu, 1 ounce; gum storax, 1 drachm; purified opium, 15 grains; best honey, 4 ounces; rectified spirits of wine, 1 pint. Digest them together for a week, and strain the liquor. This prescription is of great use in colds and habitual coughs, unaccompanied by feverish symptoms. The dose is from 1 to 3 tea-spoonfuls occasionally.

5094. Balsam Riga. Young shoots of fir (collected in March), 2 pounds; rectified spirit and water, of each 5 pints. Bruise the fir-shoots and macerate in the spirit and water for 3 or 4 days, then distill 1 gallon. Or: Mix together rectified spirit, 8 ounces; oil of juniper and compound tincture of benzoin, of each 1 ounce; agitate well and filter. Stimulant and diuretic; also used for sprains and bruises.

5095. Glycerine Balsam. This is designed to whiten and soften the skin, remove roughness, chaps, chilblains, and irritations from common causes. Take pure white wax, 1 ounce; spermaceti, 2 ounces; oil of almonds, 9 ounces. Melt together by a moderate heat in a glazed earthenware vessel, and add pure glycerine, 3 ounces; balsam of Peru, ½ ounce. The mixture is to be stirred until nearly cold, and then poured into pots. Instead of balsam of Peru, 12 or 15 drops of attar of rose may be employed.

5096. Universal Wound Balsam. Gum benzoin, in powder, 6 ounces; balsam of tolu, in powder, 3 ounces; gum storax, 2 ounces; frankincense, in powder, 2 ounces; gum myrrh, in powder, 2 ounces; socotrine aloes, in powder, 3 ounces; alcohol, 1 gallon. Mix them all together and put them in a digester, and give them a gentle heat for 3 or 4 days; then strain. 30 or 40 drops on a lump of sugar may be taken at any time, for flatulency or pain at the stomach; and in old age, where nature requires stimulation. This valuable remedy should be kept in every family ready for use; it cannot be surpassed as an application for cuts and recent wounds, and is equally good for man or animals.

5097. Pectoral Balsam. Tincture of tolu and compound tincture of benzoin, of each 2 ounces; rectified spirit, 4 ounces; mix. As a pectoral in coughs and colds. Dose, 1 tea-spoonful.

5098. Anodyne Balsam. Take of white soap, 1 ounce; opium, unprepared, 2 drachms; rectified spirit of wine, 9 ounces; digest them together by a gentle heat for 3 days; then strain off the liquor, and add to it 3 drachms of camphor. This balsam is of service in violent sprains and rheumatic complaints, when not attended with inflammation. It must be rubbed with a warm hand on the part affected, or a linen rag moistened with it, and renewed every third hour till the pain abates.

5099. Balsam of Turpentine. Melt by a gentle heat black resin, 1 pound; remove the vessel from the fire and add oil of turpentine, 1 pint.

5100. Canada Balsam. This balsam is the product of the Canadian balsam fir, a tree of very common growth in Canada and the State of Maine. When fresh, it has the consistence of thin honey, an agreeable odor, an acid taste, and a pale yellow color, nearly white. It should be perfectly transparent, and soluble in rectified oil of turpentine, with which it forms a beautiful glassy and colorless varnish, which is much used for preparing a semi-transparent copying-paper. A factitious kind is sold, but is wholly deficient of some of the properties of the genuine balsam.

5101. Factitious Canada Balsam. Dissolve 3 pounds of clear yellow resin in 1 gallon of oil of turpentine; then add ½ pint of pale linseed oil, and ½ ounce each of essence of lemon and oil of rosemary.

5102. Factitious Balsam of Tolu. Dissolve orange shellac and gum benzoin, of each 1 pound, in coarse powder; in rectified spirit, 5 pounds (in a close vessel); filter and distill off the spirit until the residuum has a proper consistence, then add a few drops of the oils of cassia and nutmeg, dissolved in a little essence of vanilla. Or: Take of balsam of tolu, 4 ounces; white resin, 16 ounces; sheep's suet, 1½ ounces, or sufficient to make it soft enough, according to climate or season.

5103. To Detect Factitious Balsam of Tolu. The genuine balsam is perfectly soluble in alcohol, forming a transparent solution. By exposure to the air it becomes hard and brittle. It is frequently adulterated, in which case it has a weaker smell, is less soluble in alcohol, and the tincture formed with that fluid is opaque.

5104. Factitious Balsam of Copaiba. Powdered gum benzoin, 4 ounces; castor oil, 1 gallon; yellow resin, 3 pounds; balsam of Canada, 2 pounds; oil of juniper, 2 ounces; oil of savine, 1 ounce; essences of orange and lemon, of each ½ ounce. Melt the resin, then add a little of the castor oil and the powdered benzoin, and withdraw the heat; when well mixed add the remainder of the castor oil, and, when nearly cold, the essences; mix well, and filter through a Canton flannel bag, adding a little coarsely powdered charcoal.

5105. Imitation Balsam of Copaiba. Balsam of Canada, 8 pounds; yellow resin, 2 pounds; castor oil, 3 pounds; oil of juniper, ¼ ounce; essential oil of almonds, 15 drops; oil of savine, 20 drops. As above.

5106. Reduced Balsam of Copaiba. Balsam of copaiba, 4 pounds; castor oil, 3 pounds; mix. Or: Balsam of copaiba, 7 pounds; castor oil, 4 pounds; yellow resin, 2 pounds. Or: Equal parts of balsam of copaiba and balsam of Canada mixed together. Or: To the last add 2 pounds of Venice turpentine. Or: Balsams of Canada and copaiba, and nut or castor oil, equal parts. Or: Copaiba, 7 pounds; nut oil, 3 pounds; yellow resin, 2 pounds; balsam of Canada, 1 pound. The above are the forms for the reduction of copaiba balsam, that have from time to time been circulated in the drug trade. For the mode of distinguishing such compounds from the pure balsam, see next receipt.

5107. To Detect Factitious or Reduced Balsam Copaiba. Chevallier recommends the following test: Place a drop of the balsam on a piece of unsized paper, and heat it until all the essential oil be expelled; it should then form a semi-transparent, well-defined spot; but if the balsam has been adulterated with a fat oil, it will be surrounded by an oily areola. According to Planche, the pure balsam, when shaken with liquid ammonia specific gravity .965, becomes clear and transparent in a few moments. Vigne says: 2½ parts pure balsam with 1 part liquor of ammonia, form a transparent mixture, which may be heated to 212° without becoming opaque. Boiled with 50 times its weight of water for 1 hour, it should lose at least half its weight.

Dr. Hager recommends the following simple mode as very reliable for detecting adulteration of copaiba balsam with turpentine oil: 5 or 6 drops of water and about 1 drachm of the balsam are mixed in a small porcelain dish with as much litharge as will make a thin ointment. This mass, at the common summer temperature, exhales the characteristic odor of oil of turpentine, even if the balsam is adulterated with only 10 per cent. of the oil.

5108. Factitious Balsam of Peru. Balsam of tolu, 1 pound; gum benzoin, 3 pounds; liquid storax, 1 ounce; sufficient rectified spirit. The gum benzoin in coarse powder is dissolved in a little of the spirit, and then mixed up with the balsam of tolu and storax, adding as much spirit as is necessary to reduce it to a proper consistence.

5109. Reduced Balsam of Peru. Balsam of Peru, 3 pounds; balsam of tolu, 2 pounds; rectified spirit enough to reduce it to a proper consistence. As above. Or: Balsam of Peru, 3 pounds; gum benzoin dissolved in the least quantity of spirit possible, 1 pound. As above.

5110. To Detect Factitious or Reduced Balsam of Peru. Genuine balsam of Peru should possess the following characteristics: It should have a consistence and appearance resembling molasses, and an aromatic odor between that of benzoin and vanilla. It should be entirely soluble in alcohol. It should undergo no diminution in volume when agitated with water. 1000 parts of the balsam should saturate exactly 75 grains of pure crystallized carbonate of soda. Its specific gravity should not be less than 1.150, nor more than 1.160.

5111. Factitious Balm of Gilead. Also called *Baume de la Mecque.* Gum benzoin, 1 pound; resin, 4 pounds; oil lemon, rosemary, caraway, of each 4 ounces; alcohol, sufficient quantity, till of proper consistence. Or: 4 ounces gum benzoin may be dissolved by heat in 1 pound Canada balsam, and to the mixture, when cold, ¼ ounce each of the oils of rosemary, lemon, and cassia, added.

5112. Hoffmann's Life Balsam, found in Continental Pharmacopœias under the name *Mistura oleoso-balsamica,* and other titles, is prepared as follows: Take 1 fluid ounce each of the oils of lavender, cloves, cinnamon, thyme, lemon peel, and mace; 3 fluid ounces each oil of bergamot and balsam Peru; and 5 pints alcohol. The oils and balsam are gradually added to the alcohol, the whole well shaken and allowed to rest for a few days in a cool place, when it is filtered and ready for use. Different European Pharmacopœias vary from each other somewhat in the proportion of the oils.

5113. Nervine Balsam or Baume Nerval. Expressed oil of mace, and prepared ox-marrow, of each 4 ounces melted together; oil of rosemary, 2 drachms; oil of cloves, 1 drachm; camphor, 1 drachm; balsam of tolu, 2 drachms; the last two dissolved in rectified spirit, 4 fluid drachms; and the whole stirred till cold.

5114. Balsam of Sulphur. Boil together in a vessel, tightly covered, 1 part flowers of sulphur and 4 parts olive oil, until they assume the consistence of a thick balsam.

5115. Balm of Rakasiri. Oil of rosemary dissolved in common gin.

5116. Balsam de Malta. Gum benzoin, 2 ounces; gum aloes, 1 ounce; alcohol, 2 pints. Mix.

Tonics.

Medicines that increase the tone of the muscular fibre, and impart vigor to the system. The principal mineral tonics are iron, zinc, copper, silver, arsenic, bismuth, mercury, and the mineral acids. The principal vegetable tonics are cinchona or Peruvian bark, cinchonine, quinine, the vegetable bitters, and some of the aromatics. Of the above, iron, bark, and its preparations, and the aromatic bitters, are those generally employed, and which prove most genial to the constitution.

5118. Stomachic Elixir. Pare off the thin yellow rinds of 6 large oranges, and put them in a quart bottle with 1 ounce gentian root, scraped and sliced, and ½ drachm cochineal. Pour over these ingredients a pint of brandy; shake the bottle well several times during that and the following day; let it stand 2 days more to settle, and clear it off into bottles for use. Take 1 or 2 tea-spoonfuls morning and afternoon, in a glass of wine or in a cup of tea. This elegant preparation is a most valuable tonic.

5119. Stomachic Elixir. Gentian root, 2 ounces; bitter oranges, sliced, 1 ounce; Virginia snake-root, ½ ounce. Bruise, and infuse for 4 days in 1 pint of brandy; then add 1 pint of water. A wine-glassful to be taken occasionally. Good for flatulency, indigestion, want of appetite, &c.

5120. Tonic Infusion. Gentian root, sliced, ½ ounce; dried orange peel, bruised, coriander seeds, bruised, of each 1 drachm;

boiling water, 12 ounces. Macerate for an hour in a lightly covered vessel, and strain the liquor. This infusion is often most beneficially employed in general debility, chronic gout, indigestion, and other ailments. The dose is from 1 to 2 ounces taken 3 or 4 times a day.

5121. Infusion of Calumba. Calumba root, 1 drachm; boiling water, ½ pint. Macerate for 4 hours and strain, adding afterwards ½ ounce of spirit of cinnamon. The dose is 1½ or 2 ounces. It is an excellent tonic, and is held in high esteem by many eminent physicians, who employ it in the latter stage of diarrhœa, bilious intermittent fever, and puerperal fever. It is also a good preparation for allaying the nausea and vomiting which often accompany pregnancy.

5122. Orange Tonic. Orange peel, 1 ounce; chamomile flowers, 1¼ ounces, and a little ginger. Put in 1 pint of boiling water. Add ½ a wine-glassful of brandy. Take a wine-glassful at a time.

5123. Spackman's Tonic and Nervine Mixture. Take ½ drachm sulphate of quinine, 6 grains tannin, 1 ounce ginger syrup, 6 drachms fluid extract of valerian, and 2 drachms compound tincture of cardamoms. Dose, a tea-spoonful 4 times a day.

5124 Tonic Aromatic Mixture. Digest in a close vessel for 3 days, agitating frequently, 1 ounce powdered pale cinchona bark, 3 drachms powdered calumba root, 2 drachms bruised cloves, and ½ ounce iron filings in 16 fluid ounces peppermint water; strain, and add 3 fluid ounces compound tincture of cardamoms, and 3 fluid drachms tincture of orange peel. Dose, 1 or 2 table-spoonfuls or more, 3 or 4 times a day.

5125. Tonic Pills. Extract of gentian, 2 scruples; sulphate of iron, 16 grains; sulphate of quinine, 10 grains. Mix, and form into pills. Take 1 pill three times a day.

5126. Tonic Tincture. Peruvian bark, bruised, 1½ ounces; orange peel, bruised, 1 ounce; brandy, or proof spirit, 1 pint. Infuse 10 days; shake the bottle every day. Pour off the liquor, and strain. Take a tea-spoonful in a wine-glassful of water twice a day, when you feel languid.

5127. Decoction of Red or Peruvian Bark. Bruised red bark, 1 ounce; water, 1 pint. Boil for 10 minutes in a covered vessel, and strain the liquor while hot.

5128. Infusion of Red or Peruvian Bark. Red bark, bruised, 1 ounce; boiling water, 1 pint. Macerate for 2 hours in a covered vessel, and strain. This is of great use in convalescence from acute diseases. It contains a considerable amount of the febrifuge and strengthening qualities of the quinine.

5129. Dr. Thompson's Bitters. Balmony bark, 1 part; poplar bark, 5 parts. Boil in water sufficient to strain 2½ gallons of water from a pound of the bark, to which add sugar, 3½ pounds; nerve powder, 2½ ounces; while hot, strain, and add best Malaga wine, 3½ gallons; tincture of meadow-fern, 1 quart. A less quantity may be made by observing the proper proportions. Dose, from half to a wine-glassful twice a day. These bitters are excellent. They are sure to correct the bile, and create an appetite by giving tone to the digestive powers.

Anodynes. Medicines which allay pain. Some act by actually assuaging pain; others by inducing sleep; a third class give ease by stupefying the senses, or lessening the susceptibility to pain. Among the principal anodynes are opium, morphia, camphor, ether, chloroform, nitrous oxide or laughing gas, &c.

5131. Anodyne Powder. Opium, ½ ounce; camphor, 3 drachms; valerian, 1 ounce; cayenne pepper, 1 ounce. Put the opium and camphor into a close bag; place it on the oven top to harden. Powder and mix. Take ¼ tea-spoonful at a time. Most valuable in colic, cramp, and severe pains.

5132. Anodyne Substitute for Opium. Take 2½ drachms each tincture of lupuline (hops), and tincture of henbane; 5 drachms camphor water. A tea-spoonful of the mixture may be given every 2 hours in cases where opium cannot be administered.

5133. Anodyne Cigars. The leaves of the belladonna (deadly nightshade), 4 parts, moistened with 1 part tincture of opium, dried and made into cigarettes of 1 drachm each; or the leaves alone, without the addition of opium, form an effective anodyne in troublesome coughs, tooth-ache, sore throat, &c.

Diaphoretics. Medicines that increase the perspiration. Those that produce this effect in a powerful degree are generally called sudorifics. The principal diaphoretics are warm diluents, as gruel, tea, barley-water, &c.; salts of the alkalies, as the citrates of potassa and soda, acetate and carbonate of ammonia, sal-ammoniac, nitre, &c.; preparations of antimony, as tartar emetic, antimonial powder, &c.; also Dover's powder, opium, camphor, ipecacuanha, alcohol, wine, &c. The use of diaphoretics is indicated in most diseases accompanied by fever and a dry skin.

5135. Balm Tea. Balm leaves, 1 ounce; fine sugar, 1 spoonful; lemon juice, 1 ounce; infused in a pint of boiling water for 20 minutes. This forms a useful drink in colds or fevers. Or it may be made just like common tea, without the lemon. Let the patient drink it frequently, especially the last thing at night, and keep himself warm during the perspiration.

5136. Herb Drink for Fevers. Infuse 1 ounce each of balm, elder-flowers, marshmallow, spearmint, and arnica-flowers, with ½ ounce anise-seed, in boiling water.

5137. Fever Mixture. Mix 2 scruples nitrate of potash with 3 drachms sweet spirits of nitre, 3 ounces solution of acetate of ammonia, 4½ ounces camphor water, and 2 drachms lemon syrup. Dose for an adult, 2 table-spoonfuls every 4 hours. Children in proportion. This mixture is excellent where the fever affects the head.

5138. Infusion to Produce Sweating. Infuse 1 ounce pleurisy root for 30 minutes in 1½ pints water. A tea-spoonful taken warm as often as the stomach will bear it.

5139. Boneset Tea. Infuse 1 ounce boneset in 1 pint boiling water for 30 minutes.

A wine-glassful as hot as possible every half hour will produce a profuse perspiration.

5140. Blessed Thistle Tea. The leaves of the blessed thistle prepared and administered in the same way as boneset (*see last receipt*), but not sufficient to produce nausea, will have a similar effect.

5141. Febrifuge Wine. The following mixture is highly recommended for fever and ague: quinine, 25 grains; water, 1 pint; Epsom salts, 2 ounces; brandy, 1 gill; sulphuric acid, 12 drops; loaf sugar, 2 ounces. Color with tincture of red saunders. Take a wine-glassful three times a day.

5142. Sweating Drops. Take of camphor, saffron, ipecacuanha, opium, and Virginia snake-root, ½ ounce each; Holland gin, 1½ pints; infuse 2 or 3 days. A wonderfully efficacious cure for fever and ague, after suitable evacuants. Dr. Beach says he finds this the best medicine for fever and ague of any with which he is acquainted. In two cases this tincture removed the paroxysms where other remedies failed.

5143. Spirit of Mindererus, or Solution of Acetate of Ammonia. Take of diluted acetic acid, 2 pints; carbonate of ammonia, in powder, a sufficient quantity. Add the carbonate of ammonia gradually to the acid, until it is saturated. This is a valuable diaphoretic, and is much employed in fevers and inflammatory diseases.

5144. Houseleek for Fevers. It is used as a cooling application to sores, ulcers, &c. The juice mixed with cream is good for inflammation of the eyes, and erysipelas. Taken inwardly it is good for fevers, cooling them down wonderfully. First give a purgative to cleanse the stomach and bowels; then bruise the houseleek; adding to the juice its weight in fine sugar to form a syrup. A table-spoonful every 2 hours. Drink balm or catnip tea. This receipt is worth gold.

5145. Sudorific, or Fever Powder. Crawley root, 1 ounce; lobelia herb, ½ ounce; pleurisy root, 1 ounce; skunk cabbage, ½ ounce. Powder, and mix them together. Dose, from ¼ to ½ tea-spoonful every one hour and a half till perspiration is produced. It may be given in balm or common tea. In fevers, inflammations, influenza, and colds, this powder is invaluable. It subdues irritation, corrects the pulse, improves respiration, and promotes sound natural sleep. It is sure, if properly administered, to arrest a fever. Keep it in a bottle, well corked.

Diuretics. Medicines which promote the secretion of urine. The principal diuretics are aqueous fluids, which act by increasing the watery portion of the blood, and certain substances which promote the secretion of urine, by stimulating the kidneys. Among the former may be classed nearly all aqueous liquids, as most of them produce diuresis, if the skin be kept cool. Among the latter may be mentioned the nitrate, acetate, and bitartrate of potassa; oils of juniper, turpentine, cajeput, and copaiba; dilute spirit and sweet spirits of nitre; decoction of common broom, &c.

5147. Diuretic Drops. Tincture of kino, ½ ounce; balsam of copaiba, spirits of turpentine, of each 1 ounce; sweet spirits of nitre, 2 ounces; queen of the meadow, 1 ounce. Mix, and add 1 scruple of camphor. Take nearly a tea-spoonful in mucilage. Most valuable for scalding urine, inflammation of the kidneys, &c.

5148. Diuretic Infusion. Parsley seeds, ¼ ounce; cleavers, ¾ ounce; burdock seeds, ¾ ounce; coolwort, ¾ ounce; spearmint, ½ ounce; juniper berries, ¾ ounce; linseed, ½ ounce; gum arabic, ¼ ounce. Pour upon these 2 quarts boiling water; infuse 2 or 3 hours, covering the vessel. Strain, and add ½ pint of best gin, 4 ounces of honey, and 3 table-spoonfuls of slippery elm. This is a most valuable diuretic; it is cooling, allays all urinary affections, gravel, scalding of urine, and causes an easy and sufficient flow of the same.

5149. Diuretic Pills. Calcined magnesia, 1 drachm; solidified copaiba, 2 ounces; extract of cubebs, 1 ounce; oil of turpentine, 4 drops; oil of juniper, 6 drops; form into 3-grain pills. Take 1 or 2 a few times a day. A sovereign remedy for diseases of the kidneys, bladder, urethra, gravel, whites, and venereal complaints.

5150. Buchu Leaves. They are diuretic and tonic, and a most valuable remedy in rheumatism, irritable bladder, gravel, stricture, &c. They are given in infusion and tincture. Infuse ½ ounce of leaves in ½ pint of boiling water, for 3 or 4 hours. A wine-glassful for a dose 2 or 3 times a day; or from 1 drachm to ½ ounce of the tincture.

5151. Compound Spirit of Juniper. Stimulant and diuretic, administered in doses of 2 to 4 drachms. This spirit, when mixed with 2 or 3 times its weight of proof spirit, makes a fair imitation of Holland gin. Take 15 ounces bruised juniper berries, 2 ounces each of bruised caraway and fennel, 1 gallon proof spirit, and about 1 quart water. Distill 1 gallon. The wholesale preparation is a solution of 2 drachms oil of juniper, ½ drachm each of the oils of caraway and sweet fennel, in 5 quarts proof spirit. If not clear, filter through magnesia.

Electuaries. These are chiefly mixtures of vegetable substances combined with syrup or honey, so as to be of a moderate consistence, neither liquid nor solid. The object of such preparations is to secure a vehicle by which medicines may be administered, so that their taste may be covered by the mixture with which they are combined.

5153. Aperient Electuary. Cream of tartar, 1 ounce; milk of sulphur, 1 ounce; sub-borate of soda, 2½ drachms; syrup of ginger, of sufficient quantity to give the required consistence. The dose is 1 or 2 tea-spoonfuls at bedtime. This will be found a mild and excellent laxative, and often is of great use in uterine obstructions.

5154. Lenitive Electuary. The mode of preparing this electuary is the following: Take of the best senna leaves reduced to a fine powder, 4 ounces; pulp of prunes, 1 pound; pulp of cassia, ½ pound; pulp of tamarinds, 3 ounces; molasses, 1½ pints; essential oil of caraway, 2 drachms. Boil the pulps with the molasses to the consistence of honey, add the senna, and when the mixture is nearly cold, add the oil of caraway, and, lastly, mix the compound thoroughly. This preparation is a mild aperient, suited to constipation from whatever cause. It is admirably suited to children and delicate persons. United with an equal quantity of flowers of sulphur, it is an admirable remedy for piles. Dose, from 1 to 3 tea-spoonfuls at bed-time.

Fomentations. In domestic practice hot fomentations are, although a simple, yet a very useful remedy for allaying pain, relieving irritation, relaxing and removing spasms, and inducing not only local, but even general perspiration. Cloths dipped in very hot water, wrung out and instantly applied on the seat of the pain, will be frequently of very great service. But in some cases it adds to the efficacy of the application to employ substances possessing medical properties in addition to the mere application of heat. In every process of fomentation there should be two flannels, each (say) three yards long, with the ends sewed together, to admit of the boiling water being wrung out of them, and the one flannel should be got ready whilst the other is applied.

5156. Anodyne Fomentation. White poppy heads, 3 ounces; elder flowers, ½ ounce; water, 3 pints. Boil until the liquor is reduced to ⅔ of its original quantity, and strain it; 2 or 3 tea-spoonfuls tincture of opium or laudanum, and 30 drops tincture of cayenne, may in some cases be added to it. This fomentation relaxes spasm, and relieves acute pain.

5157. Fomentation for Ordinary Occasions. Dried mallows, 1 ounce; chamomile flowers, dried, ½ ounce; water, 1 pint. Boil for ¼ hour, and strain the liquor.

5158. Strengthening Fomentation. Decoction of oak bark, 2 pints; alum, 3 drachms. Mix. This is a powerful astringent, and often of great use when applied to weak parts.

5159. Arnica Fomentation. Flowers of arnica, 2 ounces; rue leaves, 1 ounce; boiling water sufficient to strain 6 fluid ounces of infusion after an hour's maceration at nearly boiling temperature. Used in contusions, especially as an application to black eyes.

5160. Stimulating Fomentation. Cayenne pepper, 3 ounces; mustard seed just bruised, 2 ounces; whiskey, 2 quarts. Simmer all together a few minutes. Excellent external application in cholera, paralysis, palsy, rheumatism, &c. A less quantity may be made.

Alteratives. Medicines which effect some alteration in the nature or the quality of the vital action, and occasion a change in the habit or constitution, establishing the healthy functions of the body without producing any sensible evacuation by perspiration, vomiting, or purging. The preparations of mercury and iodine, when properly administered, are among the most useful and generally employed alteratives.

5162. Alterative Pills. Lobelia seeds, 2 drachms; mandrake, 2 drachms; blue flag, 2 drachms; blood root, 2 drachms; cayenne pepper, 1 drachm; gum guiacum, 2 drachms; extract of dandelion, 6 drachms; oil of peppermint, 3 or 4 drops; simple syrup to form into pills. Dose, 2 pills twice or thrice a day. These pills are of great service in bilious and liver complaints, diseased joints, boils, carbuncles, cutaneous eruptions, scrofula, syphilis, &c.

5163. Alterative Syrup. Tincture of cayenne, ¼ ounce; tincture of lobelia and tincture of myrrh, of each 2 ounces; molasses, ½ pound. Mix. A tea-spoonful 2 or 3 times a day. Noted for its effectual cure of cutaneous sores, boils, indigestion, and some chronic complaints.

5164. Dandelion Alterative. A useful alterative medicine, especially in cases where the function of the liver is at fault. Dose, fluid extract of dandelion, a dessert-spoonful, twice daily, with or without a little water.

5165. Blood Maker and Purifier. Mix ½ ounce sulphate of manganese with 1 pint water. Dose, a wine-glassful 3 times a day. This can be used in the place of iron tonic, or in connection with it.

5166. Pancoast's Alterative and Tonic Pills. 1 scruple extract of Ignatia amara (the bean of St. Ignatius), 1½ drachms bromide of potassa, ½ drachm saccharine carbonate of iron, 1 scruple piperine, and 1 scruple extract of henbane. Make into 60 pills, and take 2, fifteen minutes after each meal.

Emetics. Medicines which induce vomiting. The principal emetics are ipecacuanha and tartarized antimony, and their preparations; and the sulphates of zinc and copper. Ipecacuanha is usually administered in substance or infused in wine. The use of tartar emetic and antimonial wine is generally followed by nausea, relaxation of muscular power and of the circulation. Sulphate of zinc acts promptly and energetically, and its effects cease as soon as ejected from the stomach; hence it is employed to eject poison. Sulphate of copper is more violent and disagreeable, and its intense metallic taste is a great objection to its use. The operation of emetics is powerfully promoted by drinking copiously of diluents, especially of warm or tepid water. This latter is itself an emetic when taken in quantity. Its use prevents, in a great degree, excessive straining accompanying vomiting.

5168. Emetic Mixture. Ipecacuanha wine, ½ ounce; water, 1 ounce; simple syrup, ½ ounce. Mix. For a child, 20 drops or more, every quarter of an hour until vomiting ensues. An adult may take from ½ to 1 ounce.

5169. Eclectic Emetic Powder. Ipecacuanha and lobelia, of each 2 ounces; blood root, 1 ounce. Powder, and mix well. Take half a tea-spoonful every 20 minutes till it operates.

5170. Simple Emetic. Half a glass of warm water, 1 heaping tea-spoonful of salt, and another of mustard. These materials are usually to be had at a moment's notice, and form a very efficient emetic.

Patent and Proprietary Medicines.

The following receipts embrace a variety of domestic, popular, and proprietary remedies, and include many compounds which, without being proprietary, are better known by the names of the practitioners who have brought them into prominent notice than by any other title. A variety of articles not included in this place are noticed along with other preparations of the class to which they belong, or under the names of their proprietors.

5172. Dalby's Carminative. Take oils of caraway, fennel, and peppermint, each 10 drops; rub them up with 10 ounces white sugar and 5 ounces carbonate or lump magnesia, then add 1½ drachms sal-tartar and 2 ounces laudanum. Mix with 3½ pints of water.

5173. Kitchener's Peristaltic Persuaders. Turkey rhubarb, in powder, 2 drachms; oil of caraway, 10 drops; simple syrup, 1 drachm by weight; mix, and divide into 40 pills. Dose, 2, 3, or more. From 2 to 4 will generally produce one additional motion within 12 hours. The best time to take them is early in the morning.

5174. Barclay's Antibilious Pills. Extract of colocynth, 2 drachms; extract of jalap, 1 drachm; almond soap, 1½ drachms; guiacum, 3 drachms; tartarized antimony, 8 grains; oil of juniper, 4 drops; oil of caraway, 4 drops; oil of rosemary, 4 drops.

5175. Lee's Antibilious Pills. Take pulverized jalap, aloes, and rhubarb, each ½ ounce; calomel, 3 drachms; pulverized gamboge, 1 drachm; form the whole into a mass with shavings of castile soap and syrup; then make into pills.

5176. Dover's Powder. Ipecacuanha, in powder, 1 drachm; powdered opium, 1 drachm; powdered saltpetre, 1 ounce. All well mixed. Dose, from 8 to 20 grains.

The U. S. Pharmacopœia directs 1 ounce sulphate of potassa instead of the saltpetre (nitrate of potassa); in other respects the formula is the same as the above.

5177. Thompson's "Number Six." Gum myrrh, 1 pound; golden seal, 4 ounces; put these into a jug, shake several times a day for 8 days, when it is fit for use. This is a stimulant and tonic.

5178. Thompson's Composition Powder. Take bayberry, 8 ounces; ginger, 8 ounces; poplar bark, 4 ounces; white oak bark, 4 ounces; cayenne pepper, 3½ ounces; cloves, ½ ounce. Powder and mix intimately. Dissolve a tea-spoonful in a cup of boiling water, sweetened. Valuable to remove colds, influenza, fever, relax, pain in the bowels, cold extremities. As a sudorific, or for removing morbific matter, the cause of disease, it is invaluable. When taken, the patient should go to bed, and make use of any of the various appliances for promoting perspiration.

5179. Thompson's Hot Drops. Gum myrrh, 2 ounces; cayenne pepper, 1½ drachms; spirit of wine. 1 pint. Put in a bottle, and shake several times a day for a week. Take a tea-spoonful or more in a little warm tea. It is a fine remedy for rheumatism. It will relieve the headache by taking a dose, bathing the head with it, and snuffing it up the nose. It is good for bruises, sprains, swollen joints and old sores, &c., &c.

5180. Anderson's Scott's Pills. Barbadoes aloes, 24 ounces; colocynth, 1 ounce; gamboge, 1 ounce; Spanish soap, 4 ounces; oil of anise, ½ ounce; water, a sufficient quantity. To be made into 3-grain pills.

5181. Marshall Hall's Dinner Pills. Take of powdered Barbadoes aloes, soap, and powdered extract of liquorice, of each equal parts. Make a mass with molasses, and form into pills of 4 grains each.

5182. White's Gout Pills. Take of calomel, powdered socotrine aloes, powdered ipecacuanha, and acetic extract of colchicum, of each 1 drachm. Make a mass with syrup, and form into 60 pills.

5183. Abernethy's Pills. Take of powdered socotrine aloes, 48 grains; powdered ipecacuanha, 20 grains; extract of henbane, 48 grains; blue pill mass, 24 grains. Make a mass with water, and form into 24 pills.

5184. Triplex Pills. Take of powdered socotrine aloes, 2 ounces; powdered scammony, 1 ounce; blue pill mass, 2 ounces; oil of caraway, 3 drachms. Make a mass with syrup, and form into pills of 5 grains each.

5185. Peter's Pills. Aloes, jalap, gamboge, and scammony, of each 2 drachms; calomel, 1 drachm.

5186. Walter's Indian Vegetable Pills. Socotrine aloes, 1 pound; powdered gamboge, 6 ounces; compound extract of colocynth, castile soap, and Aleppo scammony, of each 3 ounces; extract of butternut, 2 ounces; African cayenne, ½ ounce; oil of cloves, 1 drachm. Mix and make into 4-grain pills.

5187. Becquerel's Gout Pills. Mix together 106 grains sulphate of quinine, 15½ grains extract of digitalis (fox-glove), and 38½ grains of colchicum seeds. Make into 50 pills. Dose, from 1 to 3 daily for several days in succession.

5188. Health Pills. *Pill salutis.* Take 2 drachms socotrine aloes, 1 drachm extract of henbane, 16 grains extract of nux-vomica, and 10 grains powdered ipecacuanha. Mix, and make into 60 pills.

5189. Leake's Pill of Health. *Pill salutaria.* Take 2 drachms calomel, 2 drachms precipitated sulphuret of antimony, ½ ounce powdered gum guiacum, and ½ ounce molasses. Mix, and make into 240 pills.

5190. Thomas' Colocynth and Mandrake Pills. Take ½ drachm compound extract of colocynth, and 3 grains resin of podophyllin. Mix, and make into 12 pills. Dose, 2 at bed-time.

5191. Parrish's Aloes and Mandrake Pills. Take 24 grains aloin, 12 grains resin of podophyllin, and 4 minims oleo-resin of ginger. Mix, and make into 24 pills. Dose, as a laxative, 1 pill; as a purgative, 2 or 3 pills.

5192. Chirayta Pills and Mixture. Dr. Reece's pills. Extract of chirayta (chiretta), 2 drachms; dried soda, 20 grains; ginger, 15 grains; mix, and divide into 36 pills. Two twice a day. Mixture: Infusion of chirayta, 8 ounces; subcarbonate of soda, 1 drachm; 2 table-spoonfuls 3 times a day.

5193. Bateman's Pectoral Drops. Compound spirit of aniseed, 16 fluid ounces; opium, 1 drachm; camphor, 1 drachm; oil of fennel, 20 drops; cochineal, 2 drachms.

Or: Proof spirit, 4 gallons; red saunders, 2 ounces; digest 24 hours, filter, and add powdered opium, 2 ounces; camphor, 2 ounces; catechu, 2 ounces; oil of aniseed, 4 fluid drachms; digest for 10 days. (*Philadelphia College of Pharmacy.*) The old wine gallon is here intended.

5194. Clutton's Febrifuge Spirit. The original formula is: oil of sulphur by the bell, oil of vitriol and sea salt, of each 1 ounce; rectified spirit, 3 ounces; mix, digest for a month, and distill to dryness.

5195. Clutton's Febrifuge Tincture. Febrifuge spirit, 8 fluid ounces; angelica root, serpentary, cardamom seed, of each 1½ drachms; digest and strain. Water acidulated with these, and sweetened to the taste, forms a cooling diuretic and diaphoretic julep. Though never admitted into the Pharmacopœia, these preparations are favorites with some practitioners.

5196. Lartigue's Gout Pills. Compound extract of colocynth, 20 grains; extract of colchicum, 60 grains; extract of opium, 1 grain; mix, and divide into 18 pills. Dose, one or more, according to their purgative effect.

5197. Baillie's Pills. Compound extract of colocynth, 1½ drachms; extract of aloes, 1½ drachms; castile soap, ½ drachm; oil of cloves, 15 drops. Make into 38 pills. 3 at bed-time occasionally.

5198. Marseilles Vinegar. Also called *vinaigre de quatre voleurs*, or *thieves' vinegar.* Dried tops of large and small wormwood, rosemary, sage, mint, rue, lavender-flowers, of each 2 ounces; calamus root, cinnamon, cloves, nutmeg, garlic, of each ¼ ounce; camphor, ½ ounce; concentrated acetic acid, 2 ounces; strong vinegar, 8 pounds. Macerate the herbs, &c., in the vinegar for 2 weeks, strain, press, and add the camphor dissolved in the acetic acid. It is said that this medicated vinegar was invented by four thieves of Marseilles, who successfully employed it as a disinfectant during a visitation of pestilence.

5199. Collier's Wine of Quinine. Take disulphate of quinine, 18 grains; citric acid, 15 grains; sound orange wine, 1 bottle, or 24 fluid ounces.

5200. Chlorodyne. The composition of this well known secret remedy has excited much attention among chemists; many formulæ have been published, but it is difficult to determine which of them approaches nearest to the chlorodyne of J. Collis Browne, its originator. There can be no doubt about the three important ingredients, chloroform, morphia, and hydrocyanic acid, nor can there be about oil of peppermint and molasses. The question is whether anything else exists in the compound. Hitherto, of the formulæ which have been published, two—one by Dr. Ogden, the other by Mr. Squire—have attracted most attention. The difference between these lay essentially in the presence of Indian hemp and capsicum as indicated by Ogden, their absence in the formula given by Squire. But besides this, the proportion of morphia, as given by the two authorities, differed greatly. Mr. Edward Smith has recently investigated the question, and published the result in the London Pharmaceutical Journal. He puts the composition of chlorodyne as follows: Mix together 4 fluid drachms chloroform, 20 grains muriate of morphia, 2 fluid drachms rectified ether, 8 minims oil of peppermint, 4 fluid drachms diluted hydrocyanic acid, 6 fluid drachms tincture of capsicum, 1 fluid ounce acacia mixture, and add 4 fluid ounces molasses. This does not give as dark a compound as the original, because the latter contains caramel; but as this has no medicinal or other value, he omits it, making up to the required volume with the molasses. Mr. Smith thinks there is no Indian hemp, because the alcoholic extract is soluble in water; but then there is capsicum, as, after the chloroform and ether (which also give pungency to the mixture) have been distilled off, the substance left behind has a hot, peppery taste. He seems to have taken much pains with the analysis.

5201. Ogden's Chlorodyne. The following receipt will furnish a preparation having the pharmaceutical properties of chlorodyne, according to Dr. Ogden: To 8 grains muriate of morphia and ½ fluid drachm water, add 20 drops perchloric acid of 25° Baumé, and heat until a clear solution is obtained; then add ½ fluid ounce molasses, previously warmed to render it fluid; heat the mixture and agitate well. When cold, add 1½ fluid drachms chloroform, 12 drops hydrocyanic acid, 1 fluid drachm tincture of Indian hemp, 2 drops oil of peppermint, and 1 drop oleoresin of capsicum. Mix thoroughly.

5202. Groves' Chlorodyne. The following is an improvement by Mr. Groves, on the receipt of Dr. Ogden. Take chloroform, 4 drachms; ether, 1½ drachms; oil of peppermint, 8 drops; resin of Indian hemp, 16 grains; capsicum, 2 grains; macerate for 2 or 3 days, and filter. Then dissolve hydrochlorate of morphia, 16 grains, in 1 ounce of syrup; add perchloric acid and water, ½ drachm each, assisting the solution by a water-bath; then, when cold, add hydrocyanic acid (Scheele's), 96 drops. Mix the solutions.

5203. Squire's Chlorodyne. Dissolve 8 grains muriate of morphia, and 16 minims oil of peppermint, in 4 ounces rectified spirit; add 4 ounces chloroform and 1 ounce ether; next dissolve 2½ ounces extract of liquorice in 17½ ounces syrup, and add 4 ounces molasses. Mix these 2 solutions together, and add 2 ounces prussic acid.

5204. Chandler's Chlorodyne. Take 8 grains muriate of morphia, ½ drachm fluid extract of cannabis indica, 10 drops oil of peppermint, 15 drops tincture of capsicum, 2 drachms chloroform, and 1 ounce each of 98 per cent. alcohol and pure glycerine. Dose, 10 to 30 drops in a wine-glass of water every 3 hours. This preparation is of a clear greenish color.

5205. **Horsley's Chlorodyne.** The following formula is the result of an analysis made by Mr. Horsley. Burnt sugar, 1 drachm; muriate of morphia, ½ grain; distilled water, 2 drachms; oil of peppermint, 6 minims; dilute prussic acid, 5 minims; tincture of capsicum, 7 minims; and chloroform, 1 drachm. Mix. It must be observed that the water is perhaps an error, as it will not mix with the chloroform, which will be found on the bottom of the bottle.

5206. **Chlorodyne.** Mix together ½ fluid ounce chloroform, 90 minims sulphuric ether, 8 drops oil of peppermint, 8 drops resin of Indian hemp (cannabis Indica), and 2 drops capsicum; shake the mixture occasionally and allow it to stand for a few days. Dissolve 16 grains muriate of morphia, by heat, in 2 drachms water; when cold, add 65 minims Scheele's hydrocyanic acid, 1 fluid drachm perchloric acid, and 2 fluid ounces molasses. Add this gradually to the first mixture, and then add sufficient molasses to make the whole measure 4 fluid ounces. Dose, 30 minims.

5207. **Chlorodyne.** Mix together 6 fluid drachms chloroform, 1 fluid drachm chloric ether, ½ fluid drachm tincture of cayenne pepper, 2 drops oil of peppermint, 8 grains muriate of morphia, 24 drops dilute hydrocyanic acid, 20 drops perchloric acid, 1 fluid drachm tincture of Indian hemp, and 1 fluid drachm molasses. Dose, 20 drops, as a soporific; 30 drops to 1 fluid drachm, as an anodyne in cholera or violent paroxysms of pain. (*Cooley.*)

5208. **Eau Médicinale d'Husson.** It is prepared, according to Dr. Williams, from the juice of colchicum flower with half the quantity of brandy; mix, and, after standing a few days, decant into small bottles. But it was more probably made from the root, as prescribed in the following formulæ:

Dry colchicum, 60 parts; in sherry, 125 parts. 20 drops for a dose. (*Paris Codex.*)

4 ounces of the fresh root, sliced, macerated in ½ pint of proof spirit. (*Want.*)

5209. **Bates' Anodyne Balsam.** Soap liniment, 2 parts; tincture of opium, 1 part.

5210. **Delamott's Golden Drops.** Muriate of iron, 1 ounce; spirit of sulphuric ether, 7 ounces; dissolve and expose to sunshine in a closely-stopped bottle till it becomes divested of color.

5211. **Gregory's Powder.** Calcined magnesia, 2½ ounces; powdered Turkey rhubarb, 1 ounce; powdered ginger, ½ ounce. Mix. The above is Dr. Gregory's formula. Some receipts add powdered chamomile. Rhubarb, 1 ounce; ginger, ¼ ounce; powdered chamomile, ½ ounce; magnesia, 2 ounces. Mix. Some druggists prepare it with the heavy carbonate of magnesia, instead of the calcined. (*See No.* 5414.)

5212. **Black Draught.** Infusion of senna, 10 drachms; sulphate of magnesia, 3 drachms; syrup of ginger, 1 drachm; aromatic spirit of ammonia, 20 drops.

5213. **Standert's Red Mixture.** Carbonate of magnesia, 4 drachms; powdered rhubarb, 2 drachms; tincture of rhubarb, 1½ ounces; tincture of opium, 1 drachm; oil of aniseed, 24 drops; essence of peppermint, 30 drops; water, 1½ pints; mix. A popular remedy for bowel complaints in the west of England.

5214. **Graves' Gout Preventive.** Orange peel, 2 ounces; rhubarb, 1 ounce; hiera picra, 2 ounces; brandy, 1 quart. Digest for a week.

5215. **Elixir of Bromide of Sodium.** Prepare this like elixir of bromide of potassium, substituting bromide of sodium for bromide of potassium, and omitting the color.

5216. **Bacher's Tonic Pills.** Alkaline extract of black hellebore, 2 drachms; extract of myrrh, 2 drachms; powder of holy thistle, 1 drachm; mix, and divide into 4-grain pills.

5217. **Daffy's Elixir.** This is similar to the compound tincture of senna; but different makers have their peculiar formulæ. The following is one of them. Avoirdupois weight seems to be intended. Senna leaves, 3¾ pounds; jalap, aniseed, caraway seed, of each 20 ounces; rectified spirit, 18 pints; sugar, 5 pounds. Infuse the senna 2 or 3 times in sufficient boiling water to yield, when strained with pressure, 4 gallons in the whole. Add to this the tincture made with jalap and seeds digested with the spirit for a week. Pour off the clear liquor and add the sugar and brandy coloring if required.

5218. **McLean's Neuralgic Liniment.** Mix together 4 grains extract of belladonna, 6 fluid ounces ammonia water, ½ fluid ounce oil of turpentine, ½ fluid ounce olive oil, and 2 fluid ounces tincture of opium. Apply during the paroxysms.

5219. **Hayes' Pile Liniment.** Melt 1 pint lard to the consistence of honey; stir in briskly 1 ounce muriatic acid until thoroughly incorporated; and add 1 ounce tincture of opium, 2 ounces oil of turpentine, and 2 drachms camphor.

5220. **Graham's Neuralgic Liniment.** Mix together 1 fluid ounce chloroform, 2 fluid drachms oil of cajeput, 1½ ounces camphor, 12 grains veratrine, and 1½ fluid ounces tincture of aconite root.

5221. **Mexican Mustang Liniment.** Take 2 fluid ounces petroleum, 1 fluid ounce ammonia water, and 1 fluid drachm brandy. Mix.

5222. **Heyle's Horse Embrocation.** Mix together 1 ounce oil of spike, 1 ounce ammonia water, 2 ounces oil of camphor, ½ ounce oil of origanum, ½ ounce tincture of opium, 1 ounce spirits of turpentine, and 2 ounces olive oil.

5223. **Barrell's Indian Liniment.** Alcohol, 1 quart; tincture of capsicum, 1 ounce; oils of origanum, sassafras, pennyroyal, hemlock, of each ½ ounce, and mix.

5224. **Allen's Nerve and Bone Liniment.** Take oil of origanum, oil of rosemary, oil of amber, oil of hemlock, of each 4 ounces; spirits of turpentine, 2 gallons; linseed oil, 3 gallons. Mix, and color with anchusa root.

5225. **Glycerine Jelly.** Used as an application to chaps and roughened parts of the skin. It may be made of pure glycerine thickened with tragacanth powder and scented with otto of roses. An imitation may be prepared in the following manner: Mix ½ drachm good soft soap intimately with 2 drachms purified honey; gradually add 5 ounces pale olive oil, stirring without intermission until all is taken up. Care must be taken not to mix in the oil too fast. Finally perfume as desired.

5226. Glycerine Paste. A stiff glutinous compound, recommended by Dr. Tilt as a basis for plaster. It is made by boiling 100 or 150 grains common starch in 1 ounce of glycerine. This is similar to Schacht's plasma. (*See No.* 5009.)

5227. King's Cordial. Dissolve in ½ pint of proof spirits, 1½ drachms each of the oils of caraway and cinnamon; extract the stones from 3 pounds of black cherries, and mash the fruit in a pan; grate 1 nutmeg; take 2 quarts of Madeira wine, 2 quarts of brandy, and 1 gallon of syrup; mix all together, and color with red saunders wood.

5228. Squire's Elixir. Opium, 1 ounce; camphor, 1 ounce; spirit of aniseed (compound), 4 pints; tincture of serpentaria, 1 pint; water, 4 pints; tincture of ginger, ½ ounce. Some receipts add a little aurum musivum.

5229. Ward's Essence for the Headache. Spirit of wine, 2 pounds; roche alum in fine powder, 2 ounces; camphor, 4 ounces; essence of lemon, ½ ounce; strong water of ammonia, 4 ounces; stop the bottle close, and shake it daily for 3 or 4 days.

5230. Henry's Magnesia. A solution of Epsom salts is precipitated by one of carbonate of potash in the cold; the precipitate is well washed, rose water being used for the last washing; it is then made up while drying into large or small cubes.

5231. Hill's Balsam of Honey. Balsam of tolu, 2 ounces; styrax, 2 drachms; opium, ½ drachm; honey, 8 ounces; spirit of wine, 32 fluid ounces.

5232. Battley's Senna Powder. Senna leaves heated until they become light in color, reduced to powder, and mixed with some finely powdered charcoal.

5233. Munro's Cough Medicine. 4 drachms paregoric with 2 drachms sulphuric ether and 2 drachms of tincture of tolu. Dose, 1 tea-spoonful in some warm water.

5234. Griffin's Tincture for Coughs. Oil of caraway and anise, each 2 drachms; saffron, ½ ounce; benzoic acid, ¾ ounce; opium, 5 drachms; camphor, ½ ounce; spirit, 6 ounces; honey, 6 ounces. When mixed and dissolved, color with burnt sugar.

5235. Derbyshire's Patent Embrocation for Preventing Sea-Sickness. Boil 2 ounces opium, 2 drachms extract of henbane, 10 grains mace, and 2 ounces mottled soap, in 3 pints of water for ½ hour. When cold, add 1 quart of rectified spirit and 3 drachms spirit of ammonia.

5236. Papier Fayard et Blayn. This preparation is now made officinal in the Paris Codex, under the name of *Papier dit Chimique.* Heat 200 parts olive oil in a capacious dish over an open fire, until vapors begin to be given off. Then add gradually, with stirring, 100 parts finely powdered minium (red lead). As soon as the first effervescence is over, continue to stir and heat the mixture until it begins again to effervesce. Then remove from the fire and stir rapidly, to remove the white scum on the surface, and at once add 6 parts white wax. This is applied to paper or muslin with a sponge or brush.

Before spreading on the paper or muslin, it must have been prepared a week earlier with the following varnish, to make it impenetrable: olive oil, 100 parts, and garlic, 10 parts, are heated together over the open fire until the moisture of the latter is dispelled and they turn a brown color, after which they are strained. To this mixture are added 80 parts oil of turpentine, 40 parts subcarbonate of iron, and 15 parts carbonate of lead (white lead) in oil. It is also laid on with a brush or sponge.

5237. Papier Fayard. Gout paper. Euphorbium, 3 drachms; cantharides, 6 drachms; powdered and digested with 4 ounces alcohol; and 3 drachms Venice turpentine added to the strained tincture. Fine paper is dipped into it and dried in the air. Mohr directs 4 drachms cantharides and 1 drachm euphorbium to be digested in 5 ounces of highly rectified spirit; filter, and add 1½ ounces Venice turpentine previously liquefied with 2 ounces resin. To be spread on the paper while warm.

5238. Papier Epispastique de Vée. This is of three strengths, distinguished by the colors white, green, and red. The composition is made by boiling cantharides for an hour with water, and lard, green ointment, or lard colored with alkanet; adding white wax to the strained fats, and spreading on paper, silk, or linen. No. 1 is made with 10 ounces cantharides to 4 pounds of lard; No. 2 of 1 pound flies to 8 pounds of green ointment; and No. 3 of 1½ pounds to 8 pounds of colored lard; and to each are added 2 pounds of white wax.

5239. Bateman's Itch Ointment. Carbonate of potassa, ½ ounce; red sulphuret of mercury, 1 drachm; hog's lard and flowers of sulphur, each 11 ounces; bergamot, 30 drops; rose water, 1 ounce. Mix the potassa and powders with a little of the lard, and rub them well together; then add the remainder of the lard, previously softened by heat, afterwards add the rose water, gently warmed. Stir till cold.

5240. Smith's Itch Ointment. Flowers of sulphur, 2 ounces; sulphate of zinc, 2 drachms; powdered hellebore, 4 drachms; soft soap, 4 ounces; lard, 8 ounces. Mix.

5241. Wiegand's Tetter Ointment. Powder and mix 2 drachms submuriate of mercury (calomel) with 1 drachm acetate of lead, and ½ drachm red precipitate. Make 42 grains of the above powder into an ointment with 2 drachms of lard or simple cerate.

5242. Wiegand's Tetter Salve. Take 8 grains of the powder in the last receipt, mix with 20 drops glycerine, 5 grains powdered camphor, ½ ounce simple cerate, and 2 drops oil of lemon.

5243. Bailey's Itch Ointment. Sweet oil, 1 pound; suet, 1 pound; root alkanet, 2 ounces. Melt and macerate until sufficiently colored, then add powdered nitre, 3 ounces; powdered alum, 3 ounces; powdered sulphate of zinc, 3 ounces; powdered vermilion, to color; oil of aniseed, oil of spike, and oil of origanum to perfume.

5244. Beddoe's Pills, for gravel, &c. Carbonate of soda, dried without heat, 1 drachm; soap, 4 scruples; oil of juniper, 10 drops; syrup of ginger, sufficient quantity for 30 pills.

5245. Mathieu's Vermifuge. Tin filings, 1 ounce; fern root, ¾ ounce; worm-seed, ½ ounce; resinous extract of jalap, 1 drachm; sulphate of potassa, 1 drachm; honey to form an electuary. A tea-spoonful every 3 hours for 2 days; then substitute the following: jalap, 2 scruples; sulphate of potassa, 2 scruples; scammony, 1 scruple; gamboge, 10 grains; made into an electuary with honey, and given in the same dose.

5246. Swaim's Vermifuge. Worm-seed, 2 ounces; valerian, rhubarb, pink-root, white agaric, of each 1½ ounces; boil in sufficient water to yield 3 quarts of decoction, and add to it 30 drops oil of tansy, and 45 drops oil of cloves, dissolved in a quart of rectified spirits. Dose, 1 table-spoonful at night.

5247. Calvetti's Manna Lemonade. Dissolve 1 ounce pure mannite in 10 ounces boiling water, and add sufficient lemon juice to flavor. To be drunk cold or iced. *Mannite* is a peculiar saccharine principle obtained in crystalline form from manna.

5248. Bond's Compound Mixture of Iron. Take 1½ drachms gum myrrh in tears, 6 drops oil of wintergreen, 2 drops oil of nutmeg, 2 scruples carbonate of potash, 1 ounce loaf sugar, ½ drachm sulphate of iron, and 7 ounces distilled water. Rub down the myrrh with the oils, add gradually a portion of the water, making a milk of myrrh; then add the potash and sugar. Dissolve the iron in the remainder of the water, and mix the two mixtures by trituration. To be bottled and well corked directly.

5249. Mialhe's Syrup for Hoarseness. Take 15 parts syrup of gum-arabic, 5 parts syrup of tolu, 5 parts maiden-hair, 1 part nitrate of potassa, and 1 part cherry-laurel water. Dose, a table-spoonful in a cup of sweet balm tea, in short draughts.

5250. Dewees' Carminative. Take ½ drachm carbonate of magnesia, 1 drachm loaf sugar, 60 drops tincture of assafætida, 20 drops tincture of opium, and 1 fluid ounce water. Dissolve the sugar in half the water; add this to the tinctures previously mixed in the bottle. Rub the magnesia with the remainder of the water; then mix together the two preparations. Direct the mixture to be shaken before used.

5251. Golden Tincture. Take 3 parts sulphuric ether, 2 parts acetated tincture of opium, and 1 part compound spirit of lavender.

5252. Golden Tincture. Sulphuric ether, 1 ounce; laudanum, 1 ounce; chloroform, ¼ ounce; alcohol, 1 ounce. Mix. This preparation is extensively used by the German physicians. Dose, from 3 to 30 drops, according to circumstances. It makes an excellent local application in neuralgia and other painful affections.

5253. Napoleon's Pectoral Pills. Ipecacuanha, 30 grains; powdered squills and ammoniac, of each 40 grains; mucilage to mix; divide into 24 pills. It is said that the above was a favorite remedy with the first Emperor of France for difficulty of breathing, bronchitis, and various affections of the organs of respiration. Dose, 2 pills night and morning.

5254. Gedding's Piles Ointment. Carbonate of lead, 4 drachms; sulphate of morphia, 15 grains; stramonium ointment, 1 ounce; olive oil, sufficient to make into an ointment.

5255. Ditchett's Remedy for Piles. Spermaceti ointment, 8 ounces; powdered galls, 1 ounce; powdered opium, 1 drachm; solution of diacetate of lead, 1½ ounces. Mix well.

5256. Brown's Bronchial Troches. Take 1 pound pulverized extract of liquorice, 1½ pounds pulverized sugar, 4 ounces pulverized cubebs, 4 ounces pulverized gum-arabic, and 1 ounce pulverized extract of conium (hemlock). Mix.

5257. Roche's Embrocation, or Whooping Cough Liniment. Olive oil, 8 ounces; oil of amber, 4 ounces; oil of cloves, a sufficient quantity to give it a strong scent. Mix. Rubbed on the chest it stimulates the skin; it is useful in general for the coughs of children; in whooping-cough, however, it ought not to be used for the first ten days of the disease. This liniment is understood to be the same as the celebrated embrocation of Roche.

5258. Dupuytren's Pills. Take 120 grains powdered guaiacum, 4 grains corrosive chloride of mercury (corrosive sublimate), and 5 grains powdered opium; make into 40 pills.

5259. Anodyne Necklaces. Beads formed of the root of henbane, and used as necklaces, to allay the pain of teething.

5260. Digestive, or Live-long Candy. Powdered rhubarb, 60 grains; heavy magnesia, 1 ounce; bicarbonate of soda, 1 drachm; finely-powdered ginger, 20 grains; cinnamon powder, 15 grains; powdered white sugar, 2 ounces; mucilage of tragacanth, sufficient quantity; beat together and divide into square, flat cakes of 20 grains each.

5261. Cholagogue. Quinine, 20 grains; Peruvian bark, 1 ounce; rhubarb, 1 ounce; sulphuric acid, 15 or 20 drops, or 1 scruple tartaric acid; brandy, 1 gill, and water to make 1 pint. Dose, 2 spoonfuls every 2 hours in absence of fever.

5262. Malone's Mixture for a Cough or Cold. Take 1 tea-cupful of flaxseed, soak all night. In the morning put in a kettle 2 quarts water, 1 handful of liquorice root (split up), ¼ pound good raisins (cut in half). Boil them until the strength is thoroughly extracted, then add the flaxseed, which has been previously soaked. Let all boil about half an hour more, watching and stirring, that the mixture may not burn. Then strain and add lemon-juice and sugar to taste. Take any quantity, cold, through the day, and half a thimbleful, warm, at night. The above is a most excellent receipt.

5263. Chapman's Copaiba Mixture. Make a mixture of ½ ounce copaiba, ½ fluid ounce sweet spirits of nitre, 2 drachms powdered acacia, 1 drachm sugar, 4 fluid ounces distilled water, 2 fluid drachms compound spirit of lavender, and 1 fluid drachm tincture of opium. Dose, a table-spoonful 3 times a day. A specific remedy for gonorrhœa.

5264. Morton's Copaiba Mixture. Take ½ ounce each copaiba and powdered cubebs, 2 drachms each acacia and sugar, 7 fluid ounces water, and ½ fluid ounce camphorated tincture of opium. Make into a mixture. Dose, a table-spoonful every 3 hours. An efficacious remedy for obstinate gonorrhœa.

5265. Jackson's Pectoral Syrup. Macerate 1 drachm sassafras pith and 1 ounce acacia in 1 pint water for 12 hours; add 21 ounces sugar, dissolve the sugar in it without heat, filter, and then add 8 grains muriate of morphia. Dose, 1 tea-spoonful every 3 hours.

5266. Ayer's Wild Cherry Expectorant. Mix together 3 grains acetate of morphia, 2 fluid drachms tincture of blood-root, 3 fluid drachms each antimonial wine and ipecacuanha wine, and 3 fluid ounces syrup of wild cherry bark. Dose, 1 tea-spoonful in catarrh, bronchitis, and influenza.

5267. Ayer's Cherry Pectoral. The following receipt is said to be somewhat near to, if not exactly identical with the receipt after which this well known article is compounded: Take of syrup of wild cherry, 6 drachms; syrup of squills, 3 drachms; tincture of blood-root, 2 drachms; sweet spirits of nitre, 2 drachms; antimonial wine, 3 drachms; wine of ipecacuanha, 3 drachms; simple syrup, 1½ ounces; acetate of morphine, 2 grains. Mix, and add oil of bitter almonds, 2 drops; dissolved in alcohol, 1 drachm.

5268. Donovan's Mixture of Cyanide of Potassium. Mix together 1 grain cyanide of potassium, 3½ fluid ounces distilled water, and ½ fluid ounce lemon syrup. Dose, a table-spoonful every 2 hours. Useful to check vomiting, and allay cough; and, in much smaller doses, for whooping cough in children.

5269. Regnault's Pectoral Paste. Flowers of mallow, flowers of cudweed, flowers of coltsfoot, and flowers of red poppy, 1 ounce of each; boil in a quart of water, strain, then add 30 ounces of gum-arabic, 20 ounces of white sugar, and 2 drachms tincture of tolu; dissolve, strain, and evaporate to the proper consistence.

5270. Dennis' Patent Anti-spasmodic Tincture. Take 1 ounce each tincture of scullcap, valerian, myrrh, and capsicum; 2 ounces tincture of lobelia; a *little* soda; and sufficient water.

5271. Goitre Jelly. Better known, perhaps, under the French name *Gelée pour le Goitre.* Dissolve 1 ounce white soap in 2½ ounces of proof spirit by a gentle heat; and add to it, while still warm, a warm solution of 5 drachms iodide of potassium in 2½ ounces proof spirit. A few drops of any fragrant and essential oil may be added.

5272. Mettauer's Aperient Solution. Take of socotrine aloes, 2½ ounces; supercarbonate of soda, 6 drachms; water, 4 pints; compound spirits of lavender, 2 ounces. After digesting 14 days, the clear liquor may be either decanted or allowed to remain. Age is said to improve both the powers and taste of the solution. The common dose is 1 drachm, which may be increased, if necessary, to an ounce. It is recommended as a valuable remedy in most forms of constipation, taken soon after meals.

5273. Coxe's Hive Syrup. Put 1 ounce each squills and Seneca snake-root into 1 pint water; boil down to one-half and strain. Then add ½ pound clarified honey containing 12 grains tartrate of antimony. Dose for a child, 10 drops to 1 tea-spoonful, according to age. An excellent remedy for croup.

5274. Bateman's Sulphur Wash. Break 1 ounce sulphur, and pour over it 1 quart of boiling water; allow it to infuse for 12 or 14 hours, and apply it to the face 2 or 3 times a day, for a few weeks. This application is equally useful in removing that roughness of the skin which generally succeeds pimples.

5275. Allcock's Porous Plaster. The only difference between this plaster and ordinary adhesive plasters is, that rubber is used in the place of lead plaster. It is a good addition, and very generally recognized by makers of adhesive plasters. Take rubber, 1 pound; pitch, ½ pound; thus, ½ pound; and capsicum, 30 grains. The plaster, as offered for sale, is spread upon muslin or linen, in which small holes have been punched out, allowing vent for perspiration, and affording increased flexibility. These plasters adhere very firmly, frequently requiring the application of heat (by means of a hot towel or warm flat-iron), for their removal. The skin may be cleansed after the removal of the plaster, by rubbing with sweet oil, until the remains of the plaster are dissolved; wiping it off, and washing with warm water and soap.

5276. Poor Man's Plaster. Take bees'-wax, 1 ounce; tar, 3 ounces; resin, 3 ounces. To be melted together and spread on paper or muslin.

5277. Universal Plaster. A plaster is officinal in several of the European Pharmacopœias, under different names, which appears to be identical with *Keyser's Universal Plaster,* which is sold extensively in this country as a nostrum. The following is the formula of the Prussian Pharmacopœia: Take of red-lead, in very fine powder, 8 ounces; olive oil, 16 ounces. Boil them in a proper vessel with constant agitation until the whole has assumed a blackish-brown color, then add yellow wax, 4 ounces; and after this has been melted and well mixed, add 2 drachms camphor, previously dissolved in a little olive oil. Pour it out into suitable boxes, or into paper capsules, to be cut into square cakes when cold.

5278. Devil Plaster. Cases of severe wounds are said to have healed without suppuration after 17 or more days by the use of this plaster. It has also been successfully applied to fractures and tumors. Take 15 drachms black pitch, 15 drachms dry resin, 2½ drachms dried earth-worms in powder, 8 drachms essential oil of turpentine, and 1 scruple crude alum. Mix well. This plaster was much used by an old surgeon of Morello, and by his sons, for the cure of wounds without the loss of substance. The composition, which they kept secret, is now published to the world by M. Escorihuela. He obtained the secret from one of the heirs.

5279. Wallace's Pills. Take socotrine aloes, scammony, and soap, all in powder, blue mass and compound extract of colocynth, 1 scruple each, to make 20 pills.

5280. Canada Liniment. Take water of ammonia, olive oil, oil of turpentine, and alcohol, of each 1 ounce; oil of peppermint, ½ ounce. Mix.

5281. St. John Long's Liniment. White and yolk of 1 egg; oil of turpentine, 6 ounces; acetic acid, 1 ounce; oil of lemon, 12 drops; and rose-water, 5 ounces. Mix.

5282. Brodie's Liniment. Take of sulphuric acid, 1 drachm; olive oil and oil of turpentine, of each 1 ounce. Add the acid gradually to the olive oil, stirring it in a mortar; when cool, add the oil of turpentine and mix.

5283. Good Old Samaritan Liniment. Mix together 2 gallons alcohol, 12 ounces oil origanum, 4 ounces oil hemlock, and 2 ounces each of oil of cedar, balsam of fir, spearmint, balsam of life (*see No.* 5112), oil of sassafras, oil of wintergreen, spirits of turpentine, and sulphuric ether. Mix.

5284. Physic's Issue Ointment. Powdered cantharides, ½ ounce; rose water, 2 fluid ounces; tartar emetic, 15 grains. Apply heat and evaporate the rose-water one-half; strain, and add olive oil, 3 ounces; white wax, 1½ ounces; spermaceti, 1 ounce. Mix, and apply a gentle heat until all the water has been driven off. When the manipulations have been conducted with care, the cerate is light in color.

5285. Beach's Black Plaster or Healing Salve. Take of olive oil, 3 quarts; common resin, 3 ounces; bees'-wax, 3 ounces. Melt these articles together, and raise the oil almost to boiling heat; then gradually add of pulverized red lead 2½ pounds, if in the summer; if in the winter, ¼ pound less. In a short time after the lead is taken up by the oil, and the mixture becomes brown or a shining black, remove from the fire, and, when nearly cold, add ½ ounce pulverized camphor.

5286. M'Kenzie's Ointment. Powdered sulphate of zinc, 4 ounces; liquid storax, 1 ounce; melted lard, 16 ounces. Mix by means of heat and triturate over a water-bath for about an hour. A useful application for tetter and scald-head. Apply night and morning, first washing the part with Castile soap and warm water.

5287. Conklin's Salve. Take resin, 12 ounces; bees'-wax, mutton suet, and tallow, of each 1 ounce. Melt together, strain the mixture through muslin, and work into rolls in a bath of cold water.

5288. Newell's Compound Tar Ointment. Lard and mutton suet, of each 12 ounces; tar, 6 ounces; bees'-wax, 3 ounces; powdered black hellebore, 4 drachms; melt and strain, then add flowers of sulphur, 4 ounces. Used for tetters, salt rheum, itch, &c.

5289. Turner's Cerate. Take of sweet oil, 2 pounds; yellow wax, carbonate of zinc, powdered, of each 1 pound. Mix at a low heat.

5290. Allison's Tobacco Ointment for Gathered Breasts. Tobacco leaves (fresh and sliced), 10 ounces; dilute acetic acid, 4 pints; basilicon ointment (*see No.* 4964), 13 ounces. Boil the tobacco in the acid, strain and evaporate the decoction over a warm bath to 4 fluid ounces; add this to the basilicon ointment, heated, and stir the whole together until cold. Apply spread upon linen or soft kid skin.

5291. Allison's Acetated Ointment of Tobacco. Tobacco leaves, sliced, 10 ounces; cider vinegar (or officinal dilute acetic acid), 4 pints; basilicon ointment (*see No.* 4964), 13 ounces. Boil the tobacco in vinegar to 1 pint, strain, reduce in a water-bath to 6 fluid ounces, and add this fluid extract to the melted ointment, stirring constantly till it is cool. A fine remedy for gathered breasts.

5292. Parrish's Compound Ointment of Tobacco. Basilicon ointment (*see No.* 4964), 13 ounces troy; powdered camphor, 29 drachms; extract of belladonna, 2 ounces; fluid extract of tobacco (made as in the above formula), 6 ounces. Dissolve the extract of belladonna in the fluid extract of tobacco and add to the melted ointment, in which the camphor should be previously dissolved. Stir constantly till cool. Dr. Parrish has stated, in the New Jersey Medical Reporter, that he uses this ointment in nearly every case of mammary abscess, with entire satisfaction.

5293. Mege's Rheumatic Ointment. Take 160 parts lard, 6 parts each of the extracts of opium, belladonna, and cinchona, 7 parts ammonia water.

5294. Mitchell's Ointment of Three. Mix together equal parts of tar ointment, sulphur ointment, and red oxide of mercury ointment.

5295. Berthold's Chilblain Wash. Boil for 15 minutes 1½ ounces bruised nut-galls in ½ pint water, and strain. Apply to the chilblains 2 or 3 times a day. Tannic acid dissolved in glycerine has a very similar effect, but in a neater form for application.

5296. Lapis Divinus. This preparation, called also *cuprum aluminatum*, is the *pierre divine* of the French codex. It is made by mixing in powder, 3 ounces each of sulphate of copper, nitrate of potassa, and alum; heating the mixture in a crucible so as to produce watery fusion; then mixing in 1 drachm powdered camphor; and finally pouring out the whole on an oiled stone to congeal. The mass, when cold, is broken into pieces, and kept in a well-stopped bottle. When this preparation is used as an eye lotion, a filtered solution is made, of the average strength of 30 grains to a pint of water.

5297. Lapis Miraculosus. Fuse together sulphate of copper, 3 parts; sulphate of iron, 6 parts; verdigris and alum, of each 1 part; sal-ammoniac, ½ part. It is used for ulcers only.

5298. Biett's Solution. This is a solution of 1 grain of arseniate (not arsenite) of ammonia in 1 troy ounce of water. It is not as safe a preparation as either Fowler's or Pearson's solution, owing to the ready decomposition of the ammonia salt.

5299. Pearson's Arsenical Solution. This is an aqueous solution of arsenite of soda, containing 1 grain of the salt in a fluid ounce.

5300. Sampson's New York Pills. The 1½ grain pills consist of powdered coca, 25; extract of coca, 30; powdered iron, 35 parts.

5301. Oil of Stone. Take crude American petroleum, and Barbadoes petroleum, of each 2 pints; oil of turpentine, 6 pints.

5302. Chelsea Pensioner. Take powdered rhubarb, 2 drachms; cream of tartar, 1 ounce; guaiacum, 1 drachm; sulphur, 2 ounces; 1 nutmeg grated fine; clarified honey, 16 ounces. Mix. Dose, 2 tea-spoonfuls night and morning. A very good remedy for chronic rheumatism.

5303. Indian Cathartic Pills. Reduce to a fine powder, 1 ounce each aloes and gamboge; ¼ ounce each mandrake, blood-root, and myrrh; 1½ drachms camphor (*see No.* 4358) and cayenne; with 4 ounces ginger. Mix thoroughly and make into ordinary-sized pills with thick mucilage. Dose, 2 to 4 pills.

5304. Turlington's Balsam is much like the compound tincture of benzoin of the Pharmacopœia of the U. S., though it is somewhat more complicated. To make it, take benzoin, 12 ounces; liquid storax, 4 ounces; balsam of Peru, 2 ounces; myrrh and aloes, each 1 ounce; balsam of tolu and extract of liquorice, each 4 ounces; angelica root, ½ ounce; alcohol, 8 pints. Digest for 10 days, and strain.

5305. Thibault's Balsam. Myrrh, aloes, and dragon's blood, of each 1 drachm; flowers of Saint John's wort, 1 handful; spirit of wine, ½ pint; Canada balsam, ½ ounce. Digest the flowers in the spirit for 3 days, then express the liquor and dissolve the other ingredients therein. To heal cuts and wounds, and to stop bleeding. Internally diuretic, in doses of 1 to 2 tea-spoonfuls; given in gonorrhœa.

5306. Locatelle's Balsam. Yellow resin, olive oil, and Venice turpentine, of each 1 pound; shavings of red saunders wood, 1 ounce. Boil to the consistence of a thin ointment, and strain.

Or: Yellow wax, 4 ounces; olive oil and Venice turpentine, of each 1 pound; alkanet root, 2 ounces; as last. Used as a pectoral in coughs and colds. Dose, ½ to 1 tea-spoonful mixed with the same quantity of conserve of roses.

5307. Bell's Gargle. Take of pure borax, 2 drachms; yeast and honey, of each ½ ounce; boiling water, 7 ounces. Mix.

5308. Mrs. Wheeler's Nursing Syrup. Mix together 35 ounces sugar, 4 ounces lime-water, ½ ounce aqueous extract of podophyllin, 4 ounces fluid extract of poppy, and 1 drachm oil of anise in 2 ounces rectified spirit. The aqueous extract of podophyllin is of the same strength as the ordinary fluid extracts, 16 troy ounces to the pint. The above syrup will be found to contain about 2 drops fluid extract of poppy in each tea-spoonful.

5309. Mrs. Wheeler's Worm Confection. Triturate to a fine powder, 1 drachm mild chloride of mercury and 10 drachms sugar; add 25 ounces sugar and 6 drachms santonin; mix all together and make into 360 tablets. Each tablet will therefore contain ⅙ grain of calomel and 1 grain santonin.

5310. Brodie's Decoction of Pareira Brava. Take ½ ounce bruised pareira root, and 3 pints boiling water; boil down gently to 1 pint, and filter. Dose, 1 wine-glassful every 2 hours. An excellent remedy for chronic inflammation of the bladder.

5311. Hufeland's Diuretic Drops. Take ½ fluid drachm oil of juniper, and 3 fluid drachms each sweet spirits of nitre and tincture of digitalis. Dose, 30 drops every 3 hours.

5312. Stephens' Infusion of Cayenne Pepper and Salt. Macerate ½ ounce powdered cayenne pepper, and 1 drachm chloride of sodium (table salt) for 1 hour in 8 fluid ounces each boiling vinegar and boiling water. Filter. Dose, 1 table-spoonful every 2 hours. This has been administered with great success in malignant scarlet fever; used both internally and as a gargle.

5313. Magendie's Acid Solution of Veratria. Dissolve 1 grain veratria in 2 fluid ounces distilled water and 5 drops aromatic sulphuric acid. Dose, 1 tea-spoonful, in gouty affections.

5314. Ryan's Gleet Powder. Take 2 scruples powdered ergot, 1 ounce powdered cubebs, ½ drachm powdered cinnamon, and 1 drachm sugar. Make into 8 powders. Dose, 1 powder 3 times a day, for leucorrhœa and gleet.

5315. Channing's Mixture. Dissolve 3½ grains iodide of potassium in 1 fluid ounce distilled water; then add 4½ grains red iodide of mercury. Dose, from 2 to 5 drops, in cases of secondary symptoms, and obstinate skin diseases.

5316. Thomas's Cathartic Pills. Take ½ drachm compound extract of colocynth, and 3 grains resin of podophyllin. Make into 12 pills. Dose, 1 or 2 at bed-time. 1 pill acts as a laxative; 3 as a free purgative.

5317. Parrish's Cathartic Pills. Take 24 grains aloin, 12 grains resin of podophyllin, and 4 minims oleo-resin of ginger. Make into 24 pills. Dose, the same as directed in the last receipt.

5318. Becquerel's Anti-Gout Pills. Take 2 drachms sulphate of quinine, 15 grains alcoholic extract of digitalis, and 2 scruples acetic extract of colchicum. Make into 50 pills. Dose, 1 pill every 3 hours.

5319. Butternut Pills. Take ½ drachm extract of butternut, 1 scruple powdered jalap and 10 grains soap. Make into 15 pills. Dose, 3 pills, and, if these do not operate, administer 2 more. Butternut is highly recommended as a cathartic in fevers, dysentery, &c.

5320. Chapman's Peristaltic Persuaders. Take 1 drachm powdered rhubarb, 10 grains powdered ipecacuanha, and 10 drops oil of caraway. Make up with sufficient powdered acacia into 20 pills. Dose, 2 pills at bed-time, in obstinate constipation.

5321. Composition Powder. Finely pulverize 2 pounds bayberry bark, 1 pound hemlock bark, 1 pound ginger, 2 ounces cayenne pepper, and 2 ounces cloves. Mix them together. This is an excellent remedy for weak stomach, dyspepsia, &c. Put ½ tea-spoonful of the mixture with a tea-spoonful of sugar into a cup of boiling water. After standing for a few moments, drink the contents.

5322. Le Gros's Itch Ointment. Take of iodide of potassium, ½ drachm avoirdupois; lard, 1 ounce; mix. Cleanly harmless, and effective.

5323. Stokes' Liniment. The formula here given for this preparation is the one adopted by the Maryland College of Pharmacy, and is believed to be as originally prescribed by Dr. Stokes. Take 3 fluid ounces oil of turpentine, ½ fluid ounce strong acetic acid, the yolk of 1 egg, 3 fluid ounces rose-water, and 1 fluid drachm oil of lemon.

5324. Mother's Cordial. Take 4 ounces each of starwort (helonias dioica), high cranberry bark (viburnum opulus), and blue cohosh (caulophyllum thalictroides), and 1 pound of partridge-berry (mitchella repens). Bruise or grind the ingredients, and macerate for 3 days with enough strong alcohol to cover; then displace from them with more alcohol 3 pints of tincture, which are set aside, and the ingredients exhausted with hot water until it passes tasteless. Add 2 pounds sugar and evaporate with a gentle heat to 5 pints; then mix with the 3 pints of tincture and flavor with sassafras.

5325. Wyndham's Pills. Gamboge, 3 ounces; aloes, 2 ounces; Castile soap, 1 ounce; nitre, ½ ounce; extract of cow-parsnip, 1 ounce. In pills of 5 grains each. (*Lee.*)

5326. Anderson's Pills. Barbadoes aloes, 24 ounces; soap, 4 ounces; colocynth, 1 ounce; gamboge, 1 ounce; oil of aniseed, ½ fluid ounce. Mix, and divide into pills of 3 grains each.

5327. Morrison's Pills. No. 1 consists of equal parts of aloes and cream of tartar; No. 2 consists of 2 parts of gamboge, 3 of aloes, 1 of colocynth, and 4 of cream of tartar, made into pills with syrup.

5328. Ayer's Sarsaparilla. Take 3 fluid ounces each of alcohol, fluid extracts of sarsaparilla and of stillingia; 2 fluid ounces each fluid extracts of yellow-dock and of podophyllin; 1 ounce sugar, 90 grains iodide of potassium, and 10 grains iodide of iron. This is from a receipt given by Dr. Ayer himself.

5329. Henderson's Lotion for Corns. Take tincture of iodine, ½ ounce; iodide of iron, 12 grains; chloride of antimony, ½ ounce. Pare the corn, and apply with a camel's-hair pencil. This lotion has been much commended for destroying corns.

5330. Velpeau's Black Caustic. Triturate in a porcelain mortar 1 ounce powdered liquorice root, and add sulphuric acid in small quantities until a mass is obtained neither too hard nor too liquid. This preparation forms a well-marked hard black scab.

5331. Jarave Spanish. Pour 4 gallons of boiling water on 2 pounds Rio Negro sarsaparilla, 8 ounces powdered guaiacum bark, 4 ounces each of rasped guaiacum wood, anise seed, and liquorice root, 2 ounces of bark of mezereon root, 2 pounds of molasses, and 12 bruised cloves. Shake it thrice a day, and keep it in a warm place. When fermentation has set in, it is fit for use. Dose, a small tumblerful.

5332. Bouyer's Syrop de Lait Iodique. Take cow's milk 200 parts; cane sugar, 60 parts; iodide of potassium, ⅙ part; and a *little* soda. Mix, and evaporate to 100 parts.

5333. Cephalic Snuff. Dried asarabacca leaves, 3 parts; marjoram, 1 part; lavender flowers, 1 part; rub together to a powder.

5334. Boeli's Cephalic Snuff consists of 2 drachms valerian, 2 drachms snuff, 3 drops oil of lavender, 3 drops oil of marjoram; mix. This is said to relieve the eyes as well as the head.

5335. Radway's Ready Relief, according to Peckolt, is an ethereal tincture of capsicum, with alcohol and camphor.

5336. Radway's Renovating Resolvent. A vinous tincture of ginger and cardamom, sweetened with sugar. (*Hager* and *Jacobsen.*)

5337. Swedish Essence of Life is made in this country, under various names. As usually made by apothecaries, it is a tincture prepared from 4 parts aloes, 1 each of agaric, rhubarb, zedoary, gentian, myrrh, and theriac, with 100 to 120 parts dilute alcohol. The medicine manufacturers usually substitute cheaper articles for the high-priced saffron and rhubarb. (*See No.* 5365.)

5338. Walker's Jesuits' Drops. Balsam of copaiba, 6 ounces; gum guaiacum, 1 ounce; Chio turpentine, ½ ounce; subcarbonate of potash, ½ ounce; cochineal, 1 drachm; rectified spirit, 1 quart.

5339. Molinari's Remedy for Sea-Sickness. Digest for 12 hours in 1¾ Imperial pints of wine vinegar, ½ ounce each of rue, thyme, mint, rosemary, absinthe, turmeric, and green walnut rind; ⅙ ounce annatto; ⅓ ounce pearlash; and 1 poppy-head. After digestion boil for half an hour; then strain through linen; in this decoction are moistened or dipped some 4 or 5 strips of filtering paper 7 or 8 inches long, and then dried; upon one side of these strips some light stuff is fastened by the corners and some loose wadding placed inside. Strings are next fastened to the bandage and it is then tied around the body so as to cover the region of the heart. This preventive of sea-sickness has been patented in England.

5340. Redwood's Nervine Balsam. Melt together 4 ounces oil of mace and 4 ounces beef marrow. Dissolve in 4 drachms alcohol, 2 drachms each oil of rosemary and balsam of tolu, and 1 drachm each of camphor and oil of cloves. Mix all together. A good liniment in rheumatism.

5341. Chaussier's Obstetric Ointment. Extract belladonna, 2 drachms; water and lard, each 2 drachms. Mix well.

5342. Dutch Drops, or Haerlem Drops. There is considerable difference in the ingredients and quality of these long-celebrated drops; but the most common preparation, perhaps, is made according to the following formula: Take balsam of turpentine, 2 ounces; oil of turpentine, 10 ounces. Mix. The following is also one of the imitations of it made in this country: Linseed oil, 1 quart; resin, 2 pounds; sulphur, 1 pound; boil together over a slow fire; when combined remove from the fire, and add 1 pint oil of turpentine, and 50 drops liquor of ammonia; stir well together and bottle. The genuine drops are the residuum of the rectification of oil of turpentine. Dutch drops are of course stimulant and diuretic in their therapeutical effects; but they have been regarded by the common people as possessed of many other virtues, and have been much applied to wounds and other external injuries of the surface.

5343. Russia Salve. Take equal parts of yellow wax and sweet oil, melt slowly, carefully stirring; when cooling, stir in a small quantity of glycerine. Good for all kinds of wounds, &c.

5344. James' Oil of Gladness. Take oil of hemlock, 1 ounce; linseed oil, 1 quart.

5345. Green Mountain Salve. Take 2 pounds resin, ¼ pound Burgundy pitch, ¼ pound bees'-wax, ¼ pound mutton tallow; melt them slowly. When not too warm, add 1 ounce oil hemlock, 1 ounce balsam fir, 1 ounce oil origanum, 1 ounce oil of red cedar, 1 ounce Venice turpentine, 1 ounce oil wormwood, ½ ounce verdigris. The verdigris must be very finely pulverized and mixed with the oils, then add as above and work all in cold water until cold enough to roll. This salve has no equal for rheumatic pains or weakness in the side, back, shoulders, or any place where pain may locate itself. Where the skin is broken, as in ulcers, bruises, &c., use without the verdigris.

5346. Keating's Cough Lozenges. These are said to be composed of lactucarium, 2 drachms; ipecacuanha, 1 drachm; squills, ¾ drachm; extract of liquorice, 2 drachms; sugar, 6 ounces. Made into a mass with mucilage of tragacanth, and divided into 20-grain lozenges.

5347. Milburn's Mixture. Precipitated prepared chalk, loaf sugar, and gum-arabic, of each 2 drachms; green mint water, 4½ ounces; laudanum, 10 minims; spirits of lavender, 2 drachms; simple syrup, 1½ ounces; tincture of kino, 1 ounce. Mix. Useful in loose bowels in children, and can be given to them after each evacuation, regardless of number. Dose, from ½ to 1 table-spoonful. Shake the mixture well each time before using it.

5348. Ricord's Aromatic Wine. Take rue, sage, hyssop, lavender, absinth, rose-leaves, thyme, and elder flowers, of each 4 ounces. Digest for 2 weeks in 9 pints claret. Then add tannic acid, alum, wine of opium, of each 9 ounces.

5349. Beyran's Wash. Dissolve chloride of zinc in 100 times its weight of pure water. This solution is used as a wash for chancres, and spontaneously or artificially opened buboes that are extending both in size and depth, and show no signs of cicatrization. It is applied twice a day by means of lint moistened with it. As soon as the vitality of the parts becomes favorably modified, Dr. Beyran replaces this wash by Ricord's wine of cinchona or aromatic wine. (*See No.* 5348.)

5350. Charta Epispastica. White wax, 4 parts; spermaceti, 1½ parts; olive oil, 2 parts; resin, ¾ parts; Canada balsam, ¼ part; cantharides in powder, 1 part; distilled water, 6 parts. Digest all the ingredients excepting the Canada balsam in a water-bath for 2 hours, stirring them constantly; then strain, and separate the plaster from the watery liquid. Mix the Canada balsam with the plaster melted in a shallow vessel, and pass slips of paper over the surface of the hot liquid, so that one surface of the paper shall receive a thin coating of plaster.

5351. Brodum's Nervous Cordial. Take equal parts of iron wine, compound sprits of lavender, tinctures of calumba, gentian, cinchona, and cardamoms.

5352. Atkinson's Infant Preservative. Carbonate of magnesia, 6 drachms; white sugar, 2 ounces; oil of aniseed, 20 drops; spirit of sal-volatile, 2½ drachms; laudanum, 1 drachm; syrup of saffron, 1 ounce; caraway water to make a pint.

5353. Boyle's Fuming Liquor. Take quicklime and sulphur, each 3 parts. Triturate together, adding water sufficient to form a paste, and incorporate 7 parts sulphate of ammonia dissolved in water; let the whole stand, then decant, wash the residuum, rubbing it with a small portion of water, unite the solutions, and filter. This is the *sulphuretted hydrosulphate of ammonia,* and is used in medicine as a powerful alterative in constitutional diseases.

5354. Hall's Solution of Strychnia. Take pure crystals of strychnia, 16 grains; water and alcohol, of each 7½ ounces; acetic acid and compound tincture of cardamoms, of each ½ ounce. Mix for solution. Dose, 20 to 30 drops, once or twice a day.

5355. Flemming's Solution of Strychnia. Take of strychnia, 2 grains; distilled water, 5 fluid drachms; muriatic acid, 1 drop, or sufficient to dissolve the strychnia. Dissolve by trituration, and add diluted alcohol enough to make 10 fluid drachms. Dose, in the beginning, 10 minims.

5356. Brandish's Alkaline Tincture of Rhubarb. Coarsely powdered rhubarb, 1 ounce; Brandish's alkaline solution, 32 fluid ounces. The original formula directs only ½ ounce rhubarb, but as smaller doses than were given by Dr. Brandish are now usually prescribed, the quantity of rhubarb is here increased. Or an alkaline infusion of rhubarb may be made by pouring boiling water, 8 parts, on rhubarb, 3 parts, and carbonate of potash, 1 part.

5357. Brandish's Alkaline Solution, or Caustic Alkali. American pearl-ashes, 6 pounds; quicklime, 2 pounds; wood ashes prepared by burning the branches of the ash, 2 pounds; boiling water, 6 gallons; slack the lime, add the rest of the water and the pearl-ashes, and lastly stir in the wood-ashes; let it stand in a covered vessel for 24 hours, and decant. To each pint add 1 drop of true oil of juniper berries. Keep it in stoppered bottles of green glass. The common liquor of potassa is usually sold for the above solution.

5358. Coating for Pills. Durden recommends collodion as a covering for pills; others, a solution of gutta percha in chloroform; but the ready solubility of these materials in the stomach may be questioned. Blanchard uses balsam of tolu dissolved in ether. Baildon recommends chloroform instead of ether for dissolving the balsam.

5359. Garrot's Covering for Pills. Soak 1 ounce purified gelatine in 2 or 3 drachms water; keep it liquefied in a salt-water bath. The pills are stuck on long pins, and dipped in the solution; when cold the pins are withdrawn, after being heated by a small flame, which melts the gelatine and closes the hole.

5360. Bochet's Syrup. Compound syrup of sarsaparilla, with senna, and 1 per cent. of iodide of potassium. Used for scrofulous affections.

5361. Betton's British Oil. Oil of turpentine, 8 ounces; Barbadoes tar, 4 ounces; oil of rosemary, 4 drachms; mix.

5362. British Oil, or Oil of Stone. Take oils of turpentine and linseed, each 8 ounces; oils of amber and juniper, each 4 ounces. Barbadoes tar, 3 ounces; seneca (petroleum) oil, 1 ounce. Mix. This is an excellent application to cuts and bruises, swellings and sores of almost any description whatever.

5363. Cochrane's Cough Medicine. This consists of an acidulated syrup of poppies.

5364. Godfrey's Cordial. The Philadelphia College of Pharmacy, to prevent the mischief arising from the different strength of this compound, directs it to be prepared as follows: Dissolve 2½ ounces carbonate of potash in 26 pints of water, add 16 pints molasses; heat together over a gentle fire till they simmer, remove the scum, and, when sufficiently cool, add ½ ounce oil of sassafras dissolved in 2 pints of rectified spirit, and 24 fluid ounces of tincture of opium, previously mixed. It contains about 16 minims of laudanum, or rather more than 1 grain of opium in each fluid ounce.

5365. Baume de Vie. Socotrine aloes, 2 drachms; rhubarb, 6 drachms; saffron, 2 drachms; liquorice root, 1 ounce; proof spirit, 8 ounces. Digest for 8 days and filter. The original Swedish form is this: Aloes, 9 drachms; rhubarb, gentian, zedoary, saffron, theriaca, agaric, of each 1 drachm; proof spirit, 2 pints. (*See No.* 5337.)

5366. Jozeau's Copahine-mege. The intention of M. Jozeau in devising this form of copaiba was to furnish an article that the stomach would be more able to digest than the crude article. To this end he proposed to himself to oxidize the copaiba, which he accomplishes by mixing nitric acid with it. The essential oil is acted on, and hyponitrous acid gas escapes into the atmosphere. The copaiba thus treated is then washed with water, until it no longer reddens litmus paper, and one-tenth part of cubebs in fine powder are added to it, the same proportion of carbonate of soda, and one-sixteenth part of calcined magnesia. The mixture is allowed to stand until it is quite solidified, and in that state it is made into small masses, which are then carefully covered with sugar.

5367. Ford's Balsam of Horehound is said to be prepared according to the following formula: horehound herb, 3½ pounds; liquorice root, 3½ pounds; water, 8 pints. Infuse for 12 hours, then strain off 6 pints, to which add camphor, 10 drachms; opium and benzoin, of each 1 ounce; dried squills, 2 ounces; oil of aniseed, 1 ounce; proof spirit, 12 pints. Macerate for 1 week, then add honey, 3½ pounds. Mix and strain.

5368. Holloway's Ointment. Take butter, 12 ounces; bees'-wax, 4 ounces; yellow resin, 3 ounces. Melt, and add vinegar of cantharides, 1 ounce. (*See No.* 1178.) Evaporate and add Canada balsam, 1 ounce; oil of mace, ½ drachm; balsam Peru, 15 drops.

5369. Holloway's Pills. Take aloes, 4 parts; myrrh, jalap, and ginger, of each 2 parts. Mucilage to mix.

5370. Sydenham's Laudanum. According to the Paris Codex this is prepared as follows: opium, 2 ounces; saffron, 1 ounce; bruised cinnamon and bruised cloves, each 1 drachm; sherry wine, 1 pint. Mix and macerate for 15 days and filter. Twenty drops are equal to one grain of opium.

5371. Riegler's Fever Tincture. Take of aloes, ½ ounce; camphor, 4 scruples; orange peel and elecampane root, of each 8 ounces. Bruise and digest with 10 pints alcohol (80 per cent.) for 8 days. Then express, add 12 ounces dilute sulphuric acid, 6 ounces sulphate of quinine, and 1½ ounces Sydenham's laudanum. (*See last receipt.*) After the use of a purgative or emetic if required, 2 drachms of this tincture are given 3 hours before the paroxysm is expected, with short diet. On the seventh, fourteenth, and eighteenth day, after the last attack, the same dose is given. This remedy fails only in very exceptional cases. It is in use in the Austrian military hospitals.

5372. Kitridge's Salve. Make a decoction in rain water of 1½ pounds each bittersweet root and sweet elder root; ½ pound each hop vines, hop leaves, and garden plantain tops, with ½ pound of the root of the last named plant, and ½ ounce plug tobacco. Strain, and press through a thick cloth, and evaporate to ½ pint. Then mix with 1 pound sweet butter and 1 ounce each resin and bees'-wax. Heat gently until the water has all evaporated. This is a good curative salve for sores on the human body as well as on animals.

5373. Thirlault's Glycero-pomade of Iodide of Potassium. Melt glycerine (of 28° to 30° Baumé), 100 parts; powdered animal soap, 50 parts, powdered iodide of potassium, 130 parts; in a warm bath; then pour out into a warm porcelain mortar, and triturate well for ¼ hour. Then flavor with 2 parts oil of bitter almonds.

5374. Elixir of Bromide of Ammonium. Prepared from bromide of ammonium as in No. 5449, without the coloring.

5375. Patent Dysentery Cordial. Take of rhubarb, catechu, and camphor, 2 parts each; laudanum, 4 parts; and a little oil of anise. Dose, 15 to 60 drops after each operation.

5376. Whitwith's Red Drops. Take oil of thyme, 4 drachms; tincture of myrrh, 2 ounces; tincture of camphor, 2 drachms; compound spirits of lavender, 2 ounces; alcohol, 8 ounces. Mix. Dose, 25 drops in some suitable vehicle, two, three, or four times a day. This is the original receipt, but it has been varied in many ways.

5377. George's Myrrhine. Glycerine, 38 parts; myrrh, 7 parts; arrow-root, 5 parts; chalk, 54 parts; oil of cinnamon, 1 part. For the preservation of the teeth.

5378. Kirkland's Neutral Cerate. Mix together 4 ounces litharge plaster, 1½ drachms acetate of lead, and 2 ounces each olive oil, precipitated chalk, and acetic acid.

5379. Hufeland's Zinc Cerate. For sore nipples, ulcerations of the breast, &c. Mix 15 grains each oxide of zinc and lycopodium, with ½ ounce simple cerate and about ½ ounce of spermaceti cerate.

5380. Deschamps' Fuligokali Ointment. This ointment has been considerably used in obstinate chronic diseases of the skin as a detersive, resolvent, and stimulant application, and is made by taking of fuligokali, 16 to 30 parts (*see next receipt*); lard, 1 ounce. Rub together.

5381. To Obtain Fuligokali. Take of potassa, 20 parts; bright soot, 100 parts; water, sufficient; boil for an hour, cool, dilute with water, evaporate to dryness, and keep in well-stoppered bottles.

5382. Hooper's Female Pills. Take 1 drachm dry sulphate of iron, 15 grains powdered jalap, 1 drachm powdered aloes and cinnamon, and 8 grains myrrh. Mix with syrup, and make into 30 pills. Dose, 2 or 3 at bedtime for several nights in succession. They purge smartly, and act beneficially as an emmenagogue. According to a recent analysis, the iron is in a peroxidized state; probably the sulphate is partially calcined. The Philadelphia College of Pharmacy gives the following formula: Barbadoes aloes, 8 ounces; dried sulphate of iron, 9½ drachms; extract of black hellebore, 2 ounces; myrrh and soap, each 2 ounces; canella, 1 ounce; ginger, 1 ounce; water sufficient to form a mass. Divide into pills of 2½ grains each.

5383. Nuremberg Plaster. Mix 8 ounces red lead with 1 pound olive oil, and expose to a heat until the mixture becomes brown or blackish; add ½ ounce resin, 1½ ounces yellow wax, and 2 drachms camphor. The red lead should not be added to the oil until so far heated as to scorch a feather dipped into it.

5384. Green Coloring Powder. Mix together 1 part indigo and 10 parts curcuma root, and reduce to a fine powder. (*Hager.*)

5385. Green Oil. Digest for 2 days, with frequent agitation, 1 part green coloring powder (*see last receipt*) in 20 parts olive oil. Decant the clear, and filter. Keep in glass bottles carefully stopped. Or: Boil 1 part fresh plantain in 8 parts olive oil, until crisp; press and filter. (*Hager.*)

Either of these will produce an oil whose appearance is identical with the oil of henbane, and is probably sometimes sold for it.

5386. Plunket's Ointment for Cancer. White arsenic, sulphur, powdered flowers of lesser spearwort and stinking chamomile, levigated together, and formed into a paste with white of egg.

5387. Hope's Camphor Mixture. Take 4 ounces camphor water, 30 drops fuming nitric acid, and 20 to 40 drops tincture of opium. Dose, a table-spoonful every 2 hours.

5388. Murphy's Carminative. Take ½ pint tincture of valerian, 10 fluid drachms acetated tincture of opium, 128 grains pulverized camphor, 248 grains carbonate of potassa, 2 ounces carbonate of magnesia, 40 minims each oil of anise and oil of mint, and 1½ pints water. Dose for an infant, 20 to 25 drops. This is said to be an improvement on Dewees' carminative. (*See No.* 5435.)

5389. Eisenmann's Opiated Wine of Colchicum. This consists of a mixture of 6 parts wine of colchicum seed and 1 part wine of opium.

5390. Pierlot's Solution of Valerianate of Ammonia. Dissolve 3 scruples extract of valerian in 7 fluid ounces spring water; add 3 fluid drachms fluid extract of valerian, and filter; then add 2 drachms valerianate of ammonia, 6 fluid drachms orange-flower water, and 6 fluid drachms simple syrup. Dose, 1 tea-spoonful 3 or 4 times a day.

5391. Brandreth's Pills. According to Dr. Hager's analysis, these consist of 10 grains extract of may-apple, 30 grains poke berry juice, 10 grains saffron, 10 grains powdered may apple root, 15 grains powdered cloves, and 3 drops oil of peppermint. This is made into 30 pills with powdered liquorice root.

5392. Foucher's Dressing for Wounds. Dissolve 2 drachms chlorate of potassa in 4 fluid ounces glycerine, and add 2½ ounces alcohol. This forms a clear liquid which is readily absorbed by linen, and does not soil the clothing. It keeps the dressings moist for 24 hours, is easily washed off with lukewarm water, and is well adapted for soft granulations.

5393. Atler's Nipple Wash. Take ½ drachm powdered gum-arabic, 10 grains borate of soda, and 1 drachm tincture of myrrh.

5394. Beach's Neutralizing Cordial. Mix together 1 ounce coarsely powdered Turkey rhubarb, ½ ounce peppermint leaves, and 1 ounce bicarbonate of potash. Put the materials in a stone jar, and add 1 pint boiling water; let it stand till cold, and then add ½ pint best brandy and ½ pound loaf sugar. Digest for a day or two, and strain through flannel. Bottle for use.

5395. Hager's Vermin Ointment. Mix together 12 parts sulphate of quinine, 2 parts muriatic acid, and 200 parts lard.

5396. Mayes' Substitute for Osgood's Indian Cholagogue. Dr. Mayes, of Mayesville, S. C., gives the following receipt, which he declares to be very similar to, if not identically the same, in taste, smell and effects, as Osgood's Indian cholagogue. Take 2 drachms sulphate of quinine; 1 drachm Tildens' fluid extract of leptandra; 4 ounces saturated tincture of queens' root; 3 drachms Tilden's extract of podophyllin (may-apple); 10 drops each of oil of sassafras and oil of wintergreen; and sufficient best New Orleans molasses to make the whole up to 8 ounces. This mixture to be well shaken up before a dose is measured; as the quinine (not being dissolved) will settle to the bottom of the bottle. The dose for adults is from 1 to 3 tea-spoonfuls 3 times a day. The dose is, however, a matter dependent entirely upon the nature of the case; and may be less or more, according to circumstances. It usually requires at least one 8-ounce bottle of the mixture to insure a permanent cure. When Tilden's fluid extracts cannot be had, saturated tinctures may be used, but in increased quantities; say rather more than double the quantity given of the fluid extract. In order, then, to preserve the due balance, the mixture must be made to measure 10 ounces, and a corresponding increase of dose must be made.

5397. Norris's Soda Mint. Soda mint, so much employed as an antacid and carminative for over-fed infants and dyspeptics, was originally a favorite prescription of Dr. Geo. Norris. His formula was the following: Mix together ½ ounce bicarbonate of soda, 1 ounce aromatic spirits of ammonia, and 1 pint peppermint water. Dose, from a dessert-spoonful to a table-spoonful for adults; from ½ to 1 tea-spoonful for infants.

5398. **Foy's Muriatic Acid Chilblain Lotion.** Muriatic acid, 1 part; water, 16 parts. To be used occasionally as a wash.

5399. **Foy's Sulphuric Acid Chilblain Liniment.** Sulphuric acid, 2 drachms; olive oil, 2½ ounces; and oil of turpentine, 1 ounce. Mix. Applied with gentle friction where the skin is not broken.

5400. **Balsam of Peru Liniment for Chilblains.** Balsam of Peru, ½ drachm; muriatic ether, 2 drachms; and laudanum, 2 drachms. To be used as a friction.

5401. **Gassicourt's Turpentine Chilblain Lotion.** Oil of turpentine, 4 parts; sulphuric acid, 1 part; olive oil, 10 parts. To be applied to the affected part night and morning.

5402. **Saunders' Petroleum Chilblain Embrocation.** Mix together petroleum, ½ ounce; alcohol, ½ ounce.

5403. **Radius' Camphor Chilblain Ointment.** Lard, suet, oil of bayberries, and wax, of each ½ ounce. Melt together and add camphor, 1 drachm.

5404. **Compound Creosote Ointment for Chilblains.** Creosote, 10 drops; solution of subacetate of lead, 10 drops; extract of opium, 1½ grains; lard, 1 ounce.

5405. **Deschamps' Pastils for Bad Breath.** Take of dry hypochlorite of lime, 2 drachms; sugar, 8½ ounces; starch, 8 drachms; gum tragacanth, 1 drachm; and carmine, 2½ grains. The pastils should be made so as to weigh about 2½ grains; 5 or 6 may be taken in the space of 2 hours. By employing starch in the preparation of the lozenges, Deschamps wishes to prevent the yellow color which they would otherwise assume.

5406. **Soubeiran's Lotion of Veratria.** Take 15 grains veratria, dissolve it in sufficient dilute muriatic acid, and add 5 drachms glycerine.

5407. **Noble's Tonic Elixir.** Take 1 ounce each of rhubarb root, orange peel, and caraway (or fennel) seed; percolate with 1 pint brandy. Dose, a tea-spoonful 3 times a day, after each meal.

5408. **Delioux's Wine for Rheumatism, Gout, and Neuralgia.** Take 5 parts tincture of colchicum seed, 2 parts tincture of aconite leaves, 1 part tincture of fox-glove, and 200 parts white wine. Dose to commence with, ½ table-spoonful 3 times a day.

5409. **Ludlam's Specific.** Take 2 drachms extract of rhatany, 1 drachm alum, 1 ounce cubebs, all in powder; 1 fluid ounce balsam of capaiba, and sufficient carbonate of magnesia. Dose, a small piece every 3 or 4 hours.

5410. **Davis' Pain Killer.** This preparation is said to be prepared as follows: Take 20 pounds powdered guaiac, 2 pounds camphor, 6 pounds powdered cayenne pepper, 1 pound caustic liquor of ammonia, and ½ pound powdered opium; digest these ingredients in 32 gallons alcohol for 2 weeks, and filter.

5411. **Hunter's Red Drop.** Triturate in a glass mortar, 10 grains corrosive sublimate in 12 drops muriatic acid, and add gradually 1 fluid ounce compound spirit of lavender. Dose, 5 to 20 drops in wine. A powerful alterative in syphilitic diseases, and will not salivate.

5412. **Battley's Sedative Solution of Opium.** Take 6 ounces sliced opium, 1½ ounces bruised nutmegs, ½ ounce Spanish saffron, and 4 pounds verjuice. Boil together, and add 4 drachms yeast; let the whole ferment 6 weeks, in a warm place. Decant, filter, and bottle; add a little sugar to each bottle. One drop of this sedative is equivalent to 3 drops of black drop.

5413. **Nimmo's Solution of Croton Oil.** Mix together ½ drachm alcoholic solution of croton oil, 2 drachms each simple syrup and guaiac mucilage, and ½ ounce distilled water. This quantity constitutes a dose; a little milk to be swallowed before and after.

The alcoholic solution referred to is formed by adding 8 drops croton oil to 1 fluid ounce rectified spirit of wine (90 per cent.)

5414. **Gregory's Powder.** Mix together 6 drachms calcined magnesia, 3 drachms powdered rhubarb, and 1 drachm powdered ginger. (*See No.* 5211.)

5415. **Remoussin's Anti-Syphilitic Gargle.** Take 1 ounce of a decoction of black nightshade and hemlock, and 3 grains bichloride of mercury.

5416. **Ricord and Favrot's Capsules of Copaiba.** Take 270 grammes (4167 grains) balsam of copaiba, 60 grammes (926 grains) neutral pepsin, 12 grammes (185 grains) subnitrate of bismuth, and 18 grammes (277½ grains) calcined magnesia. This is sufficient for 600 gelatine capsules. Dose, from 15 to 18 capsules a day.

5417. **Ricord and Favrot's Capsules of Copaiba and Tar.** Take 220 grammes (3395½ grains) balsam of copaiba, 20 grammes (308½ grains) Norwegian tar, and 15 grammes (231½ grains) calcined magnesia. To make 400 gelatine capsules. Dose, 15 every day.

5418. **Hamburg Tea.** This formula for *Hamburger Thee* is given by Hager. Mix together 8 parts senna leaves, 4 parts manna, and 1 part coriander.

5419. **Persian Balsam.** This is also known under the names of *Traumatic Elixir*, *Balm of the Innocents*, and *Baume du Commandeur*. Digest 1 ounce angelica root and 2 ounces St. John's wort, for 8 days in 5 pints 80 per cent. alcohol. Strain, and digest with 1 ounce each gum myrrh and gum olibanum. Then add 6 ounces each balsam of tolu and gum benzoin; macerate for 2 weeks; then filter.

5420. **Grahame's Elixir of Bismuth.** Dissolve 10 minims oil of orange flowers, 1 drop oil of cinnamon, 1 drop oil of cloves, and 2 drops oil of anise, in 1½ fluid drachms deodorized alcohol; add 2 fluid drachms syrup, and shake the mixture well. Dissolve 136 grains ammonio-citrate of bismuth in 2 fluid ounces distilled water and 1½ fluid ounces rose-water, adding sufficient aqua ammonia to produce a perfect solution. Mix the two solutions, add 1½ fluid ounces alcohol, and, after standing for a short time, filter un'til perfectly clear; if not bright, add about 2 fluid drachms more alcohol. This is a fine preparation, each tea-spoonful containing about 2 grains of bismuth salt.

5421. Lugol's Iodine Solution. This consists of 1 part iodine dissolved in 2 parts iodide of potassium and 20 parts water. The solution of this strength is the one generally understood as Lugol's solution.

5422. Iodine Solution for External Use. Lugol devised two other solutions of different degrees of strength from the one given in No. 5421. As follows:

Rubefacient solution, containing 1 part iodine to 2 parts iodide of potassium and 12 parts water.

Caustic solution, consisting of 1 part iodine, 1 part iodide of potassium, and 2 parts water.

5423. Camphorated Dover's Powder. Pulverize 5 drachms camphor with ether, add 5 drachms prepared chalk, 5 drachms pulverized liquorice, and 17 grains sulphate of morphine. Dose, from 1 to 10 grains, used in all kinds of fevers, and as an anodyne.

5424. Davis' Neutralizing Cordial. Take 8 ounces rhubarb, 2 ounces each saffron, cardamoms, nutmeg, and carbonate of soda; 2 pounds white sugar, and 2 ounces essence of peppermint, with sufficient brandy and water to make up to 2 pints. Dose, 1 to 2 tea-spoonfuls.

5425. German Tea for the Chest. The compound known as German *Brust-Thee* is composed of the following ingredients, cut up small and mixed together: Take 4 ounces marsh-mallow root. 1½ ounces liquorice-root, ½ ounce Florentine orris root, 2 ounces colt's foot leaves; 1 ounce each red poppy flowers, mullein flowers, and star anise seed.

5426. Frey's Vermifuge. Take 1 ounce castor oil, 1 ounce aromatic syrup of rhubarb, 30 drops oil of Baltimore wormseed, and 5 drops croton oil.

5427. Velpeau's Erysipelas Lotion. Dissolve 1 ounce sulphate of iron in 1 pint water. Apply to the part affected every 2 or 3 hours.

5428. Procter's Vermifuge. To expel stomach worms from young children. Mix 16 grains santonin with 2 fluid ounces fluid extract of pink-root and senna. Dose, for a child 2 years old, 1 tea-spoonful night and morning, until purging takes place.

5429. Laurence's Hemorrhage Solution. Dissolve 2 drachms chloride of iron in 1 fluid ounce water. Apply with a brush, to prevent gangrene and arrest homorrhage.

5430. Laurence's Styptic Solution. If the solid perchloride of iron be kept in a bottle, a small portion deliquesces after a time, forming a thick brown liquid. This, applied to a bleeding surface by means of a brush of spun glass, arrests the flow of blood almost immediately.

5431. Monsel's Styptic Solution. This consists of a solution of subsulphate of iron, and is applicable for the same purpose as Laurence's hemorrhage solution. (*See No.* 5429.) The preparation of the *solution of subsulphate of iron* is thus given in the U. S. Ph. Mix 510 grains sulphuric acid and 780 grains nitric acid with ½ pint distilled water; heat to the boiling point, and add, ¼ part at a time, 12 troy ounces sulphate of iron, in coarse powder, stirring after each addition until effervescence ceases. Boil the solution until nitrous vapors are no longer perceptible, and the color assumes a deep ruby tint. When nearly cold, add sufficient distilled water to make up to 12 fluid ounces.

5432. Patterson's Emulsion of Pumpkin-Seeds. This is a good preparation for expelling tape-worms. Take 2 ounces pumpkin seeds, peel and pound to a paste with 1 ounce sugar; then add by degrees 8 fluid ounces water. The whole to be taken in 2 or 3 draughts, at short intervals, fasting. Dr. H. S. Patterson has prescribed this repeatedly with success.

5433. Teft's Dental Anæsthetic. Mix 1 fluid ounce each tincture of aconite root, purified chloroform, and alcohol, with 6 grains morphia. Used to diminish the pain in extracting teeth, by applying two plugs of cotton, moistened with the liquid, to the gums around the tooth for 1 or 2 minutes. It must not be swallowed.

5434. Parrish's Quinine Pills. Place 20 grains sulphate of quinia on a slab, drop upon it 15 minims aromatic sulphuric acid, triturating it with a bone spatula until it becomes a thick paste. Then divide rapidly into the required number of pills. A 3-grain pill made in this manner will not be inconveniently large.

5435. Grimault's Matico Injection. The matico injection, used by Grimault, of Paris, for gonorrhœa, is prepared, according to Bjoerklund, by dissolving 4 grains sulphate of copper in 8 ounces infusion of matico. The 8 ounces of infusion are made from ½ ounce matico.

5436. Storm's Specific. Take 2 ounces sweet spirits of nitre, 1½ drachms oil of cubebs, 2 ounces balsam of copaiba, 1 drachm oil of turpentine, 20 drops oil of cinnamon, 3 ounces mucilage of gum-arabic, and sufficient tincture of cochineal to color. This preparation is preferred by many to the capsules.

5437. Milhau's Emulsion of Cod-Liver Oil. Take 1 fluid ounce syrup containing sufficient saccharate of lime to represent 6 grains of the hydrate of lime; 5 fluid ounces water, 9 fluid ounces cod-liver oil, and 6 drops essential oil of almonds. Make into an emulsion.

5438. Bumstead's Opium Injection for Gonorrhœa. An injection, composed of 1 scruple extract of opium, 1 fluid ounce glycerine and 3 fluid ounces water, passed into the urethra after every passage of urine, affords relief in local pain, and diminution of discharge.

5439. Ricord's Gonorrhœa Injection. Take 20 grains each sulphate of zinc and acetate of lead, and 4 fluid ounces rose-water. The bottle to be well shaken before using.

5440. Condy's Fluid. Dissolve ½ drachm permanganate of potassa in 1 pint water. This is an excellent lotion for burns, ulcers, and suppurating surfaces, relieving the pain and removing the fetid odor.

5441. Dewees' Tincture of Guaiacum. Digest for a few days 4 ounces powdered gum-guaiac, 1½ drachms carbonate of soda (or of potassa), and 1 ounce powdered allspice, in 1 pint dilute alcohol. Add 1 or 2 drachms volatile spirit of ammonia to every 4 ounces of the tincture. To be administered in doses of 1 tea-spoonful in a little sweetened milk, or in sherry wine, morning, noon and night, in cases of suppressed menses. This is an excellent and well-tried remedy.

5442. Powell's Cough Balsam. Mix together 2 drachms syrup of tolu, 1 ounce paregoric elixir, and 2 ounces liquorice juice.

5443. Steer's Opodeldoc. I. Rectified spirit, 1 quart; castile soap, 5 ounces; camphor, 2½ ounces; oil of rosemary, 2½ drachms; oil of origanum, 5 drachms; weaker ammonia, 4 ounces; digest till dissolved, and pour while warm into wide-mouthed bottles.

II. Rectified spirits, 8 pints; white soap, 20 ounces; camphor, 8 ounces; water of ammonia, 4 ounces; oil of rosemary, 1 ounce; oil of horsemint, 1 ounce; dissolve the soap in the spirit by a gentle heat, and add the other ingredients. Bottle whilst warm.

5444. Falk's Antacrid Tincture. This alterative has been found a valuable remedy in secondary syphilis and other disorders. Macerate for 7 days 1 ounce powdered guaiac, 1 ounce Canadian balsam, and 2 fluid drachms oil of sassafras, in 8 fluid ounces alcohol. Filter, and add 1 scruple corrosive sublimate. Dose, 20 drops in wine or sweetened water, night and morning.

5445. Hufeland's Pectoral Elixir. Take 3 parts saffron, 4 parts each benzoin, myrrh, gum-ammoniac, aniseseed, and purified liquorice-juice; 8 parts each sneezewort root, Florentine orris-root, and squill-bulbs; macerate for a week in 93 parts rectified spirit, stirring frequently, then filter.

5446. Hufeland's Aperient Elixir. Reduce to coarse powder 4 parts each of aloes, myrrh, and gum-guaiacum; add 4 parts bruised rhubarb-root, 2 parts bruised saffron, 8 parts carbonate of potassa, 8 parts muriate of ammonia, 48 parts spirit of horse-radish root, and 144 parts distilled water. Macerate the ingredients for a few days, frequently stirring, then filter. (*Hager.*)

5447. Hufeland's Anticatarrh Elixir. Take 60 parts extract of blessed-thistle, 20 parts extract of bitter-sweet, dissolve them in 480 parts fennel water and 60 parts bitter-almond water. Dose, 60 drops 4 times a day. (*Hager.*)

5448. Meyer's Water of Life. Take 18 parts fresh myrtle-berries, 12 parts orange-peel, 8 parts cinnamon, 2 parts galanga-root, 2 parts zedoary-root, and 1 part cardamoms. Reduce them by bruising and cutting, and digest them for 3 days with frequent agitation, in 600 parts rectified spirit and 680 parts water; then strain with pressure, and let it settle; decant the clear, filter it, and add 120 parts white sugar. (*Hager.*)

5449. Elixir of Bromide of Potassium. Dissolve 1 ounce bromide of potassium and 1 ounce sugar in 1 pint simple elixir; add 20 minims solution of oil of orange and 10 minims of solution of oil of bitter almonds, and filter; color with cochineal color. The officinal formula for preparing bromide of potassium is given in No. 4198.

5450. Hufeland's Infant Powder. Take 2 ounces valerian root; 3 ounces orris root; 1 ounce aniseed; 2 drachms saffron, all in powder, and 2 ounces carbonate of magnesia.

5451. Granville's Counter-Irritant Lotions. These consist of three ingredients, viz.: *strong water of ammonia* (specific gravity .872) more than 3 times the strength of officinal liquor ammonia; of *spirit of rosemary,* made by infusing 2 pounds of the fresh tops of rosemary in 8 pints alcohol for 24 hours, and distilling 7 pints; and of *spirit of camphor,* composed of 4 ounces camphor dissolved in 2 pints alcohol.

The lotion is prepared of two different strengths; the *milder lotion* consists of 4 drachms of the ammonia, 3 drachms of the spirit of rosemary, and 1 drachm of the camphor spirit.

The *stronger lotion* contains 5 drachms of the ammonia, 2 of the spirit of rosemary, and 1 of the camphor. The milder is generally sufficient to produce full vesication in from 3 to 10 minutes. The stronger is seldom used except in apoplexy, and to produce cauterization.

5452. Startin's Borax and Glycerine Lotion. For sore lips, chapped hands, &c. Take ½ drachm borax, ½ fluid ounce glycerine, and 7½ fluid ounces rose-water.

5453. Brainard's Solution for External Use. Dissolve 16 grains lactate of iron in 2 fluid drachms distilled water.

5454. Birch's Pills for Habitual Constipation. Take ½ drachm alcoholic extract of rhubarb, 24 grains extract of taraxacum, and 2 grains sulphate of quinine. Mix together and make into 12 pills. One to be taken either on rising in the morning or at dinner time, or even at both periods when the constipation is very obstinate. This is a very gentle stomachic and tonic evacuant, particularly useful for the delicate.

5455. Da Costa's Chronic Constipation Pill. Take 1 grain podophyllin, 1 grain extract belladonna, 5 grains capsicum, and 20 grains powdered rhubarb; mix and divide into 20 pills. One pill to be taken 3 times a day.

5456. Birch's Constipation Pill. Take 12½ grains compound extract of colocynth and 40 grains extract of henbane. Mix and divide into 20 pills. This is an excellent pill for occasional use, especially for constipation in old age.

5457. Ricord's Copaiba and Pepsine Pills. Take 11½ drachms balsam of copaiba, 2½ drachms neutral pepsine, 31 grains nitrate of bismuth, and 46 grains calcined magnesia. Divide into 100 capsules. Administer 15 to 18 daily.

5458. Lime Juice and Glycerine. Lime (or lemon) juice, ½ pint. Heat in a porcelain mortar to near the boiling point, and add gradually rose water, elder-flower water, and rectified spirit, of each 2 ounces. Agitate the whole well together. After 24 hours' repose, decant or filter through calico or muslin, then add pure glycerine, 2½ ounces; oil of lemons, ½ drachm. Again agitate them together for some time, and by careful manipulation you will have a somewhat milky liquid; but it should be quite free from any coarse floating matter or sediment.

5459. Boudault's Pepsine Pills. Mix 2 drachms and 34 grains starchy pepsine, with sufficient powdered tragacanth to make

60 pills. Dose, 3 pills before and 3 after each meal, and sometimes 3 during the meal.

5460. Hogg's Pepsine Pills. Mix 2 drachms 34 grains starchy pepsine, 1 drachm 17 grains nitrate of bismuth, and 38½ grains lactic acid. Make into 100 pills, and coat with sugar and balsam of tolu. Dose, 4 to 12 pills 1 hour after meals.

5461. Angelot's Remedy for Ulcerated Gums. Take of hypochlorite of lime, from 10 to 25 grains; mucilage of gum-arabic, 1½ to 4 drachms; syrup of orange peel, 1½ to 2 drachms. Mix thoroughly. This mixture is employed as a lotion to the ulcerated gums.

5462. Angelot's Pastils for Bad Breath. These preparations are better adapted than liquids for carrying on the person. Take of hypochlorite of lime, 7 drachms; sugar flavored with vanilla, 3 drachms; gum-arabic, 5 drachms. The pastils are made so as to weigh from 10 to 11 grains. 2 or 3 of these pastils are sufficient to remove from the breath the disagreeable odor produced by tobacco smoke. The pastils thus prepared have a grey color and become quite hard.

If pastils of whiter color are required the following substances are employed: Take of dry hypochlorite of lime, 20 grains; pulverized sugar, 1 ounce; gum tragacanth, 16 grains. The hypochlorite of lime is triturated in a glass mortar, and a small quantity of water is poured upon it; it is then left to repose, decanted, and a second quantity of water added; the two liquids are filtered, and the gum and sugar added so as to form a paste. This is divided into pastils weighing from 12 to 16 grains. If it is desired to aromatize the paste, 1 or 2 drops of any essential oil may be added to the sugar and gum before the paste is formed.

5463. Santonin Lozenges. Take 5 troy ounces white sugar in powder, ¼ troy ounce fine starch, 10 grains finely powdered tragacanth; the whole well mixed with the white of 5 eggs previously beaten to a dense froth; place in a porcelain dish over the water-bath, and, with constant stirring, keep at a temperature not exceeding 100° Fahr. until a sample taken from the mixture no longer runs from the spatula. An intimate mixture of 50 grains powdered santonin and 100 grains powdered sugar is incorporated with the mass, and the whole, by means of a syringe, formed into 100 lozenges, each containing ½ grain of santonin. They are deposited on smooth or waxed paper, and when hard are to be placed between cotton-wadding and protected from the light.

5464. Quesneville's Ferruginous Powder. Bicarbonate of soda, 4 parts; tartaric acid, 7 parts; pure sulphate of iron, 4 parts; sugar, 8 parts. Powder each fine, then mix and keep the powder in a well-corked bottle. Dose, 1 spoonful in 6 or 7 ounces of sweetened water.

5465. Tronchin's Cough Syrup. Powdered gum-arabic, 8 ounces; precipitated sulphuret of antimony, 4 scruples; anise, 4 scruples; extract of liquorice, 2 ounces; extract of opium, 12 grains; white sugar, 2 pounds. Mix, and form lozenges of 6 grains, one of which is to be taken occasionally in catarrh and bronchial affections.

5466. Pierquin's Cough Syrup. Kermes mineral, 2 grains; gum-arabic, 1 drachm; syrup, 5 ounces. Mix. A spoonful occasionally when expectoration is difficult.

5467. Kermes Mineral. Dissolve 23 troy ounces carbonate of soda in 16 pints boiling water; add 1 troy ounce finely powdered sulphuret of antimony, and boil for an hour. Filter rapidly into a warm earthen vessel, cover closely and cool slowly. After 24 hours decant the fluid, drain the precipitate on a filter, wash it with cold water (previously boiled), and dry without heat. Keep in a well-stopped bottle, protected from the light. (*U. S. Ph.*) This is the *oxysulphuret of antimony.*

5468. Rousseau's Laudanum. Dissolve 12 ounces white honey in 3 pounds warm water, and set it aside in a warm place. When fermentation begins add to it a solution of 4 ounces selected opium in 12 ounces water. Let the mixture stand for a month at a temperature of 86° Fahr.; then strain, filter, and evaporate to 10 ounces; finally strain and add 4½ ounces proof alcohol. Seven drops of this preparation contain about 1 grain of opium.

5469. Bonnamy's Dentifrice. Take prepared chalk, 1 part; burned hartshorn, 1 part; hydrate of alumina, 1 part; perfume with oil of cinnamon. This is an excellent dentifrice.

5470. Extract of Milk. *Condensed milk* is thus prepared: Take 10,000 parts fresh cows' milk, 50 parts white sugar, and 2 parts pure carbonate of soda. Place them in a porcelain vessel, and, with constant stirring, evaporate to the consistence of a thick extract, either in a vacuum or by the heat of a vapor bath of 140° to 160° Fahr. One part of the extract will represent 10 parts of fresh milk. (*Hager.*)

5471. Milk Powder. Take 10,000 parts fresh cows' milk, 2 parts dry caustic potassa, and 2 parts borax. Evaporate these in a vacuum to about 2000 parts. Then mix in thoroughly 50 parts precipitated phosphate of lime, 15 parts table salt, 100 parts powdered gum-arabic, and 200 parts powdered sugar. Evaporate the whole to a dry powder at a heat of 95° to 110° Fahr. (*Hager.*)

5472. Schwarz's Liniment for Scalds and Burns. Take 16 parts linseed oil, 8 parts white of egg, and 1 part tincture of opium; mix them thoroughly by trituration with 2 parts acetate of lead. Spread upon lint and apply to the wound. (*Hager.*)

5473. Hungarian Liniment. Pulverize 5 parts cantharides, 20 parts each mustard seed, black pepper, and camphor; macerate for 2 days in 200 parts wine vinegar, then add 400 parts rectified spirits. Strain with pressure, and filter. (*Hager.*)

5474. Bland's Ferruginous Pills. Take equal weights of sulphate of iron and carbonate of potassa; make into a mass with mucilage of tragacanth and powdered liquorice root.

5475. Castillon's Powders. Take 1 drachm each sago, jalap, and tragacanth, all in powder; 1 scruple prepared oyster shell, and sufficient cochineal to color. Boil 1 drachm of this mixture in a pint of milk, and use the decoction as a diet in chronic bowel affections.

5476. Goulard's Cerate. This is the same preparation as the *cerate of subacetate of lead* of the U. S. Pharmacopœia. Mix 4 troy ounces melted white wax with 7 troy ounces olive oil. When it begins to thicken, gradually pour in 2½ fluid ounces solution of subacetate of lead, stirring constantly with a wooden spatula until cool. Then mix in 30 grains camphor dissolved in 1 fluid ounce olive oil.

5477. Gondret's Ammoniacal Ointment. Take 32 parts lard and 2 parts oil of sweet almonds. Melt together by a gentle heat, and pour the mixture into a wide-mouthed bottle. Add 17 parts of a solution of ammonia of 25° Baumé, and mix thoroughly until cold. Keep it in a cool place, and in a bottle with an accurately fitting stopper. It will vesicate, or raise a blister under the skin in 10 minutes if properly prepared.

Medical Receipts.

The scope of this work does not allow of the insertion of much beyond general and specific remedies for ailments of every-day occurrence; it being understood that, in all serious cases, the guidance of a physician is indispensable. Advice and directions are given for the treatment of some severe cases requiring prompt action, that may be followed with benefit until the arrival of the doctor. No particular school of medicine is adhered to, the efficacy of each receipt being the primary consideration in inserting it. The list includes many popular and domestic remedies, together with prescriptions of celebrated and leading physicians.

5479. To Cure Prairie or Seven Years' Itch. Use plenty of castile soap and water, and afterwards freely apply iodide of sulphur ointment; or take any given quantity of simple sulphur ointment and color it to a light-brown or chocolate color with the subcarbonate of iron, and perfume it. Apply this freely; and, if the case is severe, administer mild alteratives in conjunction with the outward application.

5480. Sulphur Bath. The bath may be prepared either by adding 1 ounce sulphuret of potassium for every 10 or 12 gallons of water used, or 1 ounce sulphuret of calcium for every 15 gallons of water. The sulphur bath is a powerful remedy in every description of skin disease. Leprosy (the most obstinate of all) has been completely cured by it; the common itch requires only 1 or 2 applications to eradicate it; all scurfy and moist skin affections, &c., speedily yield to its influence.

5481. Benzine for Itch. Benzine, it is said, will effect a cure for scabies in the course of half an hour, after which the patient should take a warm bath for 30 minutes. This has been highly recommended.

5482. To Cure Salt Rheum. Wash the part affected with castile soap and water, dry with a soft cloth; then wet with tincture of iodine, and let it dry; after which apply a little citrine ointment. (*See No.* 4947.) When the eruption is on an exposed part, a wash composed of 1 drachm corrosive sublimate, 2 scruples white vitriol (sulphate of zinc), 3 drachms sal-ammoniac, 2 drachms salt, and 3 ounces sugar of lead, mixed with 1 pint soft water, may be used alternately with the tincture of iodine.

5483. Salt Rheum from Photographic Chemicals. Make a salve by steeping queen of the meadow root over a slow heat in fresh hog's lard for from 2 to 6 hours—the longer the more powerful the salve. Apply this to the eruptions as often as convenient, and in a short time there will be a decided improvement and a cure will be effected in from 1 to 6 weeks. If the stomach or blood should seem out of order, take Winchester's hypophosphites of lime and soda. Use this medicine and no other, as it acts without fail and to the point, not being in any way injurious. Avoid using either iron or mercury, as they do no good and are very apt to do injury. Where the disease is not hereditary a cure will be effected in a short time; where it has become a chronic difficulty the cure will be slower. When buying the root, ask for queen of the meadow root. Be careful not to get queen's root, commonly called stillingia, many druggists not knowing the difference.

5484. Baker's Itch. This disease is of common occurrence on the hands of bakers; hence the vulgar name. The treatment is as follows: Frequent ablution in warm water, keeping the bowels open with saline purgatives, and the nightly use of the ointment given in No. 4957 will generally effect a cure. Salt food should be avoided as much as possible, as well as keeping the hands covered with dough and flour; the latter being the cause of the disease.

5485. Remedy for Tetter, Ring-worm, and Scald-Head. Take 1 pound simple cerate; sulphuric acid, ¼ pound; mix together, and it will be ready for use.

5486. Remedy for the Tetter. Dissolve 1 ounce sulphuret of potash in 1 quart of cold soft water; put it into a bottle and keep it tightly corked. Bathe the eruption 5 or 6 times a day, with a sponge dipped in a little of this solution. If the tetter reappear in cold weather, repeat the treatment. This is an excellent remedy.

5487. Remedy for Barber's Itch and Tetter. A simple and effectual cure. Moisten the part affected with saliva (spittle) and rub it over *thoroughly* three times a day with the ashes of a good Havana segar. Simple as this remedy may appear, it has cured the most obstinate cases.

5488. To Cure Ring-worm. To 1 part sulphuric acid, add 16 to 20 parts water. Use a brush or feather, and apply it to the parts night and morning. A few dressings will generally cure. If the solution is too strong, dilute it with more water; and if the irritation is excessive, rub on a little oil or other softening application; but always avoid soap.

5489. Cure for Ring-worm. Wash the head with soft-soap every morning, and apply the following lotion every night: 1

drachm sub-carbonate of soda, dissolved in ½ pint of vinegar.

5490. To Cure Pimples and other Eruptions of the Skin. Never tamper with any breaking-out on the skin; even though it be a single red spot, do not apply to it so simple a thing as water, hot or cold, but let it alone, and omit a meal or two; if it does not abate, consult a physician. If one is not at hand, then live on half allowance until it disappears.

5491. Glyconine, or Glycerine Varnish for Cutaneous Affections. Take yolk of egg, 4 parts by weight; rub in a mortar with 5 parts glycerine. Applied to the skin it forms a varnish which effectually excludes the air, and prevents its irritating effects. It is unalterable (a specimen having laid exposed to the air for 3 years unchanged), and is quickly removed by water. These properties render it serviceable for erysipelas and cutaneous affections, of which it allays the action. It is also very valuable for soothing the irritation resulting from burns.

5492. Cure for Eruptions of the Skin. Take 2 ounces rasped sarsaparilla root, 1½ ounces solanum dulcamara (bitter-sweet, or woody nightshade), 1½ ounces mezereon bark, ½ ounce rasped guaiacum wood, and ½ ounce sassafras bark. Pour on these 1 quart boiling water, let it stand 24 hours, and then boil away slowly to 1½ pints; press, strain, and add 2 pounds sugar and 1 ounce diluted spirits of wine. Take a wine-glassful 3 times a day with 1 grain precipitated sulphuret of antimony.

5493. Treatment of Sprains. The great remedy is rest; when severe, rest for days, to save weeks; the best treatment is warm fomentations at the time of accident, to prevent or reduce the swelling and pain, and arnica, applied by means of rags, to prevent pain and give strength to the part. The tincture of arnica is the preparation used. If the skin is not broken, about 20 to 30 drops, or even, in severe cases, 60 drops may be added to a wine-glassful of water. If the skin is broken, or any abrasion is present, the strength of the tincture must be considerably reduced; from 5 to 10 drops will then be sufficient, and if any redness or inflammation occurs in or about the sprain, in consequence of using the lotion, leave it off at once and use only cold water. A firm bandage will be useful to support the part. Walking should, for a considerable time, be only sparingly indulged in after a severe sprain.

5494. Remedy for a Sprain or Bruise. Wormwood boiled in vinegar, and applied hot, with enough cloths wrapped around to keep the sprain moist. This is an invaluable remedy.

5495. Sprains of the Wrist and Ankle. As soon as possible after the accident, get a muslin bandage 1 or 2 yards long, and 2 or 3 inches wide; wet it in cold water, and roll it smoothly and firmly around the injured part. Keep the limb at rest, exposed to the air, and continually damp with cold water. The sooner after the accident the bandage is applied, the less pain and swelling there will be; but if pain becomes excessive, care must be taken to slightly loosen the bandage.

5496. Sprains of the Muscles of the Back. Take of Canada turpentine, ½ ounce; soap liniment, 6 ounces; and 1 drachm of laudanum. Mix, and rub well in before a hot fire.

5497. Sprain in the Back. The first thing is rest; take night and morning 15 or 20 drops of the balsam of copaiba. If the part is inflamed, apply cold water cloths. Let the bowels be kept gently open by aperients. When the inflammation is gone, rub the part with stimulating liniment. (*See No.* 4888.)

5498. Treatment of Scratches. Do not neglect them. Wash them in cold water; close them as much as you can, and cover with diachylon plaster. If there is inflammation, apply a bread poultice, or one of slippery elm.

5499. To Extract Splinters. Thorns and splinters finding their way under the skin frequently give considerable pain, and, unless extracted, the annoyance may be very great, as inflammation will in all probability ensue, which is the process nature adopts for getting rid of the cause of irritation. If the splinter or thorn cannot be immediately extracted, for which purpose a needle will be found in most cases a sufficient surgical instrument, linen dipped in hot water ought to be bound around the place, or the part may be bathed in hot water. In the event of inflammation, which may probably issue on the production of an ulcer, the steam of hot water should be applied, and afterwards a poultice of bread and milk.

5500. Treatment of Cuts. The divided parts should be drawn close together, and held so with small pieces of strapping or adhesive plaster stretched across the wound, or by the application of collodion. If the part be covered with blood, it should be first wiped off with a sponge. When the wound is large, and the parts much exposed, a good method is to sew it up. The application of a little creosote will generally stop local bleeding, provided it be applied to the clean extremities of the wounded vessels. A good way is to place a piece of lint, moistened with creosote, on the wound previously wiped clean, or to pour a drop or two of that liquid upon it. Friar's balsam, quick-drying copal varnish, tincture of galls, copperas water, black ink, &c., are popular remedies applied in the same way. A bit of the fur plucked from a black beaver hat is an excellent remedy to stop the bleeding from a cut produced by the razor in shaving. For light cuts with a knife, or any sharp instrument, the Riga balsam usually stops the bleeding immediately. (*See Lockjaw.*)

5501. Artificial Skin for Cuts, &c. A small quantity of collodion applied with a brush to a cut or wound will produce a perfect artificial covering which is more elastic than plaster, and sufficiently insoluble in cold water.

5502. Traumaticine, or Water-proof Covering for Wounds. This article is simply a solution of white and dry pure unmanufactured gutta-percha in bisulphuret of carbon. Dropped on a wound or raw surface, it almost instantly forms a pliable, water-proof, and air-tight defensive covering to the part, resembling, in appearance, goldbeater's skin. The fetid odor of the bisulphuret is lost in a few seconds. Chloroform, which has an agreeable odor, may be used as the solvent, but is very much more expensive than the bisulphuret of carbon.

5503. Treatment of Bed-Sores. Remove the excessive discharge by gently pressing the part with a bit of cotton wadding; then paint the sore over with prepared collodion (*see No.* 4744), using a soft camel-hair pencil. The application may be repeated daily, and when it has well dried place a bit of soft lint or cotton wadding over the part for protection.

5504. Detergents. Deterge means to cleanse. Detergents remove unwholesome matters adhering to and obstructing the vessels; usually applied to foul ulcers, &c., as tincture of myrrh, honey, alum, water, turpentine, &c.

5505. Treatment of Ulcers. An ulcer is an injury done to the flesh, from which issues matter, or some kind of discharge, with more or less pain and inflammation. The common ulcer should be kept clean and cool, and protected from the atmosphere, especially in frosty or cold weather. It should be washed now and then with warm soap-water. Put upon it a little lint, wet occasionally with salt and water, and put over it the black salve. (*See No.* 4971.) Perhaps the best dressing is the saturnine cerate. (*See No.* 4968.) Poultices made of the oak bark or sumach bark may be used alternately.

5506. Treatment of Severe Ulcers. Sometimes ulcers are very irritable, tender, and painful, and discharge a thin acrid fluid. They should be steamed every night with a bitter decoction, and occasionally washed with an infusion of chamomile flowers, or a strong decoction of wild cherry bark, with a little spirit. Apply a poultice of slippery elm, mixed with a strong decoction of poplar bark, and a trifle of salt. Repeat as required. If the ulcer or ulcers are indolent, steam as before, and apply the cancer plaster (*see No.* 5047,) with only a trifle of the white vitriol mixed with it; or, sprinkle the ulcer with powdered blood-root. Sometimes ulcers become very much inflamed, and assume a livid color; they are covered with small vesicles or blisters, as in mortification. Wash the ulcer with tincture of myrrh, and apply a poultice made of charcoal, yeast, slippery elm, ginger, and a minute portion of tincture of cayenne. Bear it as long as possible. Then apply the saturnine cerate. (*See No.* 4968.)

5507. Beach's Remedy for Ulcers. The following is recommended by Dr. Beach: Take sweet clover tops and stalks, burdock leaves, and parsley, a handful of each; get the strength out by boiling; strain, and add 1 pound of resin and ½ pound of fresh butter; simmer until of a proper consistence. A cold water cloth constantly applied is a good remedy. Put a little cerate on the ulcer previously. Attend to the general health by cleansing the stomach and bowels, and then giving tonics.

5508. To Disinfect and Deodorize Foul Ulcers. Permanganate of potassa disinfects rapidly the most fetid ulcers, in the proportion of 2 scruples of the salt to 8 ounces of water as a lotion or injection. The most favorable method is to cover the wound with lint soaked with that substance, and to place above this a layer of raw cotton, the latter having the property of filtering the air, and to retain the germs which determine putrid fermentation. In cancers of the womb it is necessary to repeat the injections several times a day,

5509. Ulcers in the Mouth. If the ulcers are not of a syphilitic origin, a local wash of carbolic acid or permanganate of potassa will speedily cure them; say 1 part of acid or permanganate to 100 of water. If they are, however, syphilitic, the wash of carbolic acid, perhaps 2 or 3 times as strong, in combination with internal treatment, will be found beneficial; the wash may be used 3 times a day.

5510. Treatment of Running Sores on the Legs. Wash them in brandy, and apply elder leaves, changing twice a day. This will dry up all the sores, though the legs were like a honey-comb. Or, poultice them with rotten apples. But take also a purge once or twice every week.

5511. Fine Clay as a Dressing to Sores. Dr. Schreber, of Leipsic, recommends the use of clay as the most energetic, most innocent, simple, and economical of palliative applications to surfaces yielding foul and moist discharges. He moreover considers that it has a specific action in accelerating the cure. Clay softened down in water, and freed from all gritty particles, is laid, layer by layer, over the affected part. If it becomes dry and falls off, fresh layers are applied to the cleansed surface. The irritating secretion is rapidly absorbed by the clay, and the contact of air prevented. The cure thus goes on rapidly. This clay ointment has a decisive action in cases of fetid perspiration of the feet or armpits. A single layer applied in the morning will destroy all odor in the day. It remains a long time supple, and the pieces which fall off in fine powder produce no inconvenience. (*Brit. Med. Journ.*) We can corroborate Dr. Schreber's observations, having used fine clay poultices for several years, chiefly, however, in cases of local inflammation requiring the application of cold. Rags wet in water, or Goulard water, so rapidly become dry and hot that the benefit from the cold application is completely lost. There is no dirt when the clay is enveloped in a piece of fine linen, and is not too fluid in consistence. (*Braithwaite.*)

5512. Treatment of Burns. In regard to the treatment of burns there is a great diversity of opinion, scarcely any two surgeons agreeing as to the remedies. All of them are doubtless valuable, but there is one which has a great reputation (namely, carron oil, *see No.* 5513). The great objection to it is its offensive odor, rendering an entire hospital ward disagreeable. In all cases of burns and scalds, it is necessary to observe that, if fever should ensue, laxative medicines ought to be given; as castor oil, or salts and senna.

5513. Carron Oil. This is composed of equal parts linseed oil and limewater, and should be well shaken before using.

5514. Treatment of Recent Burns. When recently inflicted, nothing tends more decidedly to soothe or deaden the suffering than cold water; the burnt part should, therefore, be immediately placed in cold water, or thin cloths dipped in cold water should be applied and frequently renewed over the injured surface. After the lapse of a short time, when the cold fails to relieve, rags dipped in carron oil (*see No.* 5513) are to be substituted for the water, care being taken to keep the rags moist with the oily mixture until the burn heals; this is the main point in the treatment; the rag or linen must not be removed or changed. The carron oil may be applied from the first if it is at hand; but, cold water being nearly always to be had, will be found very grateful until assistance arrives. A large bottle of carron oil should be kept in every nursery cupboard, or in every house, in a place easy of access, a large label being affixed to it, with plain directions.

5515. Treatment of Superficial Burns. When the burn is very superficial, simply inflaming or vesicating the part, covering it up with flour, and then placing a layer of cotton over it, so as to exclude the air, makes a very comfortable dressing. Another method consists in applying cold water; and another, warm water covered with oiled silk and a bandage. Glyconine or glycerine varnish (*see No.* 5491) is also a valuable remedy. Lard, deprived of salt, and simple cerate, make pleasant applications.

5516. Gross' Treatment of Burns. The profession is indebted to Prof. Gross for the introduction of white lead and linseed oil in the treatment of burns. It is one of the very best applications which can be used, effectually excluding the air, and being always grateful to the patient. In all cases, no matter whether merely the skin or the deeper structures are involved, white lead, rubbed up with linseed oil to the consistence of paste or paint, and placed on with a brush, will be found productive of great relief. There does not appear to be any risk from the constitutional influence of the lead, though it has been suggested, to counteract any tendency of this kind, that the patient should take occasionally a little sulphate of magnesia.

5517. Burns and Scalds. Every family should have a preparation of flaxseed oil, chalk, and vinegar, about the consistency of thick paint, constantly on hand for burns and scalds. A noted retired physician states that he has used it in hospital and private practice for the past forty years, and believes that no application can compare with it, as regards relief of pain and curative results.

5518. Remedy for Scalding. Apply a poultice of slippery elm bark and milk, and, when the inflammation has left, apply black salve. (*See No.* 4971.) For very slight burns, the black salve alone will cure. The slippery elm poultice is a sovereign remedy, and has effected the greatest cures. Dr. Beach relates a case of severe scalding, in which a poultice of slippery elm bark and olive oil alone very soon arrested the inflammation and acute sufferings of the patient, to the astonishment of all who witnessed the cure.

5519. Remedy for Scalded Mouth. In cases of scalding the mouth with hot liquids, gargle with a solution of borax, and then hold in the mouth a mucilage of slippery elm, swallowing it slowly, if the throat also has been scalded; the slippery elm bark may be mixed with olive oil. Some recommend soap liniment, but the latter must not be swallowed.

5520. To Cure Slight Burns. When a burn is only trifling, and causes no blister, it is sufficient to apply a compress of several folds of soft linen upon it, dipped in cold water in which has been dissolved a little carbonate of soda; to be renewed every 15 minutes until the pain is removed. Dr. Tissot says, in cases of blisters, beat up an egg with 2 table-spoonfuls olive oil or linseed oil, spread it on soft linen, and apply it to the affected part. For very slight burns or scalds, the black salve alone is sufficient to remove the pain and inflammation. (*See No.* 4971.) If the skn is not broken, cover the part with a layer of flour or starch, place cotton wool over it, or a linen rag, and bind it over lightly. If a blister has been burst or cut, use a cerate.

5521. Carbolic Acid for Burns or Scalds. The best application in cases of burns or scalds is a mixture of 1 part of carbolic acid to 8 of olive oil. Lint or linen rags are to be saturated in the lotion, and spread smoothly over the burned part, which should then be covered with oiled silk or gutta-percha tissue, to exclude the air. The dressing may be left on from 2 to 3 days, and should then be reapplied, exposing the burn as short a time as possible to the air.

5522. Oil of Brown Paper. Dip a piece of thick brown paper into the best salad oil. Set the paper on fire upon a plate, and the oil that drops from it is a good remedy for burns.

5523. Treatment of Burns and Discolorations Caused by Gunpowder. Dr. Davies, in a recent number of the London Lancet, states that he has found the following treatment most successful: Smear the scorched surface with glycerine, by means of a feather, then apply cotton wadding; lastly, cover with oil silk. In one case the discoloration was very great, the patient looking more like a mummy than a living being. It entirely subsided in a month by the above treatment.

5524. Nature of Rheumatism. Rheumatism is a diseased condition of the fibrous and muscular tissues, chiefly affecting the larger joints; the heart and diaphragm are also liable to be affected by it. It is a promoting cause of heart disease. The principal forms of rheumatism are these: When the joints about the back and loins are affected the complaint is known as lumbago; pains in the hip joints are designated sciatica.

5525. Causes of Rheumatism. The causes of rheumatism are various. Vicissitudes of temperature are the most common; occupying a damp bed for a single night is sufficient to engender the disease. Such persons as blacksmiths, who are exposed to severe changes of temperature, are generally victims to the complaint. Miners and persons employed in smelting-furnaces are often severe sufferers. There is likewise a hereditary tendency to the malady, which a slight cold will develop. Rheumatism proceeds from a vitiated condition of the blood. A hereditary taint in the circulating fluid may be developed by a slight cold, but more commonly the blood becomes vitiated through mal-assimilation and a faulty digestive action. The precise principle of the poison engendered has not yet been fully ascertained. It is generally believed to be lactic acid.

5526. Premonitory Symptoms of Rheumatism. An attack of rheumatism is imminent when a stiffness is felt in the joints, combined with a dryness of the skin and a burning thirst. The variety of the complaint of which these signs are the precursors is termed acute. The other variety is chronic rheumatism. The latter may be described as an aggravated condition of the former, though some persons not only describe them as quite distinct, but introduce a variety between them.

5527. Treatment of Rheumatism. In the early stages, when there is much thirst, a refreshing saline drink will be beneficial; cold water may be freely allowed, but acid drinks must not be given without consulting the doctor, as they may not agree with his medicines. A correspondent of the Medical Circular vouches for the relief he has experienced in the liberal use of lime (or lemon) juice, while laboring under the paroxysms of rheumatism. By persistent use of the above simple acid for the space of 3 days, avoiding all stimulating liquids, the most confirmed rheumatism will, he says, relax, and the tone of the muscular and nervous system will be restored to its usual character.

5528. Local Remedies for Rheumatism. Unless anything else is ordered, cotton-wadding wrapped around the swollen joints, and covered with oil silk, will be found grateful; a kind of local vapor bath is produced by it. If this is not agreeable, rags may be dipped in a saturated solution of nitre in water, and applied, care being taken to keep them moist; oiled silk should be applied round these as well.

5529. Treatment of Chronic Rheumatism. When rheumatism becomes chronic, the general health, particularly the diet in connection with the digestive powers, must be attended to with great care. The attacks often arise from pure debility, and will then be best cured by tonics and good food.

5530. Simple Remedy for Rheumatism. Bathe the parts affected with water in which potatoes have been boiled, as hot as can be borne, just before going to bed; by the next morning the pain will be much relieved, if not removed. One application of this simple remedy has cured the most obstinate rheumatic pains.

5531. Dover's Rheumatic Powder. Ipecacuanha powder, and purified opium, of each 1 part; sulphate of potassa, 8 parts; triturate them together to a fine powder. Be very careful to reduce the opium, and intimately mix with the rest. This powder is recommended by Dr. Dover as an effectual remedy for rheumatism. The dose is from 2 to 5 grains, repeated. Avoid much drinking after taking it, or it might act as an emetic.

5532. Remedy for Rheumatism. Take ½ ounce each black cohosh root, golden seal, and nerve powder; 1 pint of rum. Mix. Dose, ½ table-spoonful 3 times a day. The most obstinate cases of rheumatism have yielded to the above simple remedy.

5533. Speedy Cure for Rheumatism. Dr. R. H. Boyd states that he cures inflammatory rheumatism in from 3 to 7 days by the following method: Give first a full emetic dose of tartar emetic (1½ to 2 grains), and when this has operated, 5 drops laudanum and 5 drops tincture of colchicum, every 3 or 4 hours, and a tea-spoonful of a half-pint mixture, containing 4 drachms acetate of potassa, every hour. When the patient becomes very hungry, and is quite free from pain, having fasted several days, he allows 2 table-spoonfuls of milk or 1 oyster 3 times a day, increasing the quantity gradually each day.

5534. Remedy for Inflammatory Rheumatism. Gelseminum, administered in doses of 5 to 30 drops, is a very serviceable remedy. The dose should be repeated at intervals until the pain and inflammation disappear.

5535. Rheumatic Alterative. Macerate for 3 or 4 days ½ ounce each colchicum seed and black cohosh root, both well bruised, in 1 pint best rye whiskey. A dessert-spoonful 3 times a day, before meals, has been found a valuable remedy in chronic rheumatism.

5536. Indian Remedy for Rheumatism. Macerate the following ingredients for a few days in 1 quart rye whiskey: 1 ounce bark of wahoo root, 1 ounce blood root, 2 ounces black cohosh root, ½ ounce swamp hellebore, 1 ounce prickly ash bark, and 1 ounce poke root cut fine. Dose, 1 tea-spoonful every 3 or 4 hours, increasing the dose as the stomach will bear it.

5537. Spanish Cure for Chronic and Syphilitic Rheumatism. Take 4 ounces sarsaparilla, 1 ounce rasped guaiacum wood, 2 ounces extract of sarsaparilla, ½ ounce crude antimony. Tie them in a linen rag with 10 drachms English walnut hulls (or black walnut), and boil in 3 pints water down to 2 pints; strain. Dose, a wine-glassful every hour.

5538. Jackson's Cure for Chronic Rheumatism. 1 drachm cajeput oil; ½ ounce syrup of myrrh; 3½ ounces syrup of gum-arabic. Dose, 1 tea-spoonful 3 times a day.

5539. Caution to Painters. Painters should seldom wash their hands in turpentine, as the practice, if persisted in, will lead to the most serious results, even to the loss of power in the wrist joints. It has a tendency to enlarge the finger joints, renders the hands more sensitive to cold in winter, and lays the foundation of rheumatism.

5540. Rheumatic Decoction. Virginia snake-root, 1 drachm; sarsaparilla in powder, 6 drachms; burdock seed, 2 drachms; poke root, 2 drachms; wine-pine bark, 2 drachms; cayenne pepper, ½ drachm. Powder them, and add 3 quarts of water. Boil down to 2 quarts. A cupful 2 or 3 times a day. It is most valuable in chronic rheumatism.

5541. Lumbago. It is a species of chronic rheumatism, which affects the muscles of the lower part of the back, causing great pain and stiffness. The patient can scarcely stir without having the most piercing pain. It may be confined to one side, or affect the loins generally. Its attacks are generally sudden, immediately after or in stooping, or rising from bed. Lumbago is connected with derangement of the stomach, bowels, and kidneys.

5542. Remedy for Lumbago. Rectified oil of turpentine, 25 drops; sulphuric ether, 1 scruple; mucilage of gum-arabic, 3 drachms; syrup of poppies, 1 drachm; rose-water, 1½ ounces; make into a draught; take at bed-time.

5543. Remedy for a Weak Back. Take a beef's gall, pour it into 1 pint alcohol, and bathe frequently.

5544. Remedy for Neuralgia. A remedy said to be efficacious consists in applying bruised horse-radish to the wrist on the side of the body where the pain is.

5545. Excellent Remedy for Neuralgia. A remedy, which is sometimes instantaneously successful, is mixing equal parts of sweet oil, spirits of hartshorn, and chloroform; shake it well, and before time is allowed for its particles to separate, wet a bit of rag or lint, place it on the painful spot for about a minute, or less if relieved sooner, but hold a handkerchief on the lint, so as to confine the volatile ingredients; if kept on too long, the skin may be taken off.

5546. Effective Cure for Neuralgia. Apply a blister of Spanish flies, and let it remain until it draws the skin *red* (not longer); then take it off, and apply a morphine powder. This is often very effectual.

5547. Jackson's Neuralgia Remedy. Mix 1½ drachms iodide of potassa, 15 grains sulphate of quinine, 1 ounce ginger syrup, and 2½ ounces water. Dose, a table-spoonful every 3 hours.

5548. Whitlow, or Felon. The severity of the inflammation in whitlow varies considerably; there is the mild form, which generally yields to fomentation with hot water cloths or poultices; and if matter forms, if relieved by the lancet, it speedily heals; but there is a much more formidable affection, in which the deep textures of the finger are involved, accompanied by severe pain, throbbing, and much redness, heat, and swelling. This form is only to be relieved by free and early incisions with the lancet; for if this be neglected, the bones will become affected, and will be destroyed. It would therefore be advisable to submit the finger to the inspection of a surgeon when it does not easily yield to fomentations or a poultice.

5549. Treatment of Whitlow. Steam the whole hand with bitter herbs for 30 or 40 minutes; bathe it frequently in strong hot lye water. The steaming must not be dispensed with. Or: Immerse the diseased finger in strong lye as long and as hot as can be borne several times a day. Apply a poultice of linseed and slippery elm, with a little salt and brandy. The formation of matter is indicated by a small white spot in the center of the swelling. When this appears, open it with the point of a large needle or probe, that the matter may escape. Repeat if necessary. If proud flesh appears, apply the vegetable caustic or chloride of potassium, diluted. A poultice of powdered hops is very effectual to relieve pain. Apply the *black salve* (*see No.* 4971), to heal it. Attend to the general health, by giving aperients, tonics, and nutritious cooling diet.

5550. Simple Cure for a Felon. As soon as the parts begin to swell get the tincture of lobelia, and wrap the part affected with cloth saturated thoroughly with the tincture, and the felon is dead. An old physician says that he has known it to cure in scores of cases, and it never fails if applied in season.

5551. Bone Felon. The following receipt for the cure of bone felon is given by that high authority, the London Lancet: As soon as the disease is felt, put directly over the spot a blister of Spanish fly, about the size of the thumb nail, and let it remain for 6 hours, at the expiration of which time, directly under the surface of the blister may be seen the felon, which can be instantly taken out with the point of a needle or a lancet.

5552. To Cure Felons. Stir ½ tea-spoonful water into 1 ounce Venice turpentine with a rough stick until the mixture appears like granulated honey. Wrap a good coating of it round the finger with a cloth. If the felon is only recent, the pain will be removed in 6 hours.

5553. Treatment of Boils. When these appear, suppuration should be promoted by poultices of bread and linseed meal, to which a little glycerine or fat or oil may be added, to prevent their getting hard. When poultices are inconvenient, exposure to the vapor of hot water, or the application of stimulating plasters, may be adopted instead. When sufficiently ripe, the boil should be opened with a lancet, the matter evacuated, and the wound dressed with a little simple ointment spread on a piece of clean lint or linen. The diet may be full and liberal until the maturation of the tumor and the discharge of the matter, when it should be lessened, and the bowels opened by some saline purgatives, as salts or cream of tartar. When there is a disposition in the constitution to the formation of boils, the bowels should be kept regular, and tonics, as bark or steel, taken, with the frequent use of sea-bathing, if possible.

5554. Carbuncle. A carbuncle is a species of boil, but larger, and much more painful. It shows debility in the constitution. Carbuncles are very dangerous, and medical advice should at once be obtained.

5555. Astringents. Substances that constrict the animal fibre, and coagulate albumen. When employed to check bleeding, they are called *styptics.* The principal vegetable astringents are catechu, kino, galls, and oak bark; the principal mineral astringents are sulphate of iron, nitrate of silver, chloride of zinc, sulphate of copper, acetate of lead, &c.

5556. To Stop Bleeding. If a man is wounded so that blood flows, that flow is either regular or by jets or spirts. If it flows regularly, a vein has been wounded, and a string should be bound tightly around below the wounded part, that is, beyond it from the heart. If the blood comes out by leaps or jets, an artery has been severed, and the person may bleed to death in a few minutes; to prevent which, apply the cord above the wound, that is, between the wound and the heart. In case a string or cord is not at hand, tie the two opposite corners of a handkerchief around the limb, put a stick between, and turn it round until the handkerchief is twisted sufficiently tight to stop the bleeding, and keep it so until a physician can be had. This appliance is called a *tourniquet*.

5557. **To Stop the Bleeding from Leeches.** Make a ball of cotton about the size of a pea; put this pellet of cotton or lint upon the wound; press it down firmly; keep up the pressure for a quarter of an hour. Remove the finger cautiously, taking care to let the pellet remain.

5558. **Pancoast's Styptic.** Take carbonate of potash, 1 drachm; castile soap, 2 drachms; alcohol, 4 ounces. Mix. This styptic has been found preferable to the persulphate of iron in many of the minor cases of hemorrhage, inasmuch as it leaves the surface of the stump in a healthy condition, and does not produce the thick incrustation so often objectionable after the application of the iron.

5559. **Styptic Collodion.** This is made by uniting equal parts of collodion and chloride of iron. It is recommended for erysipelas.

5560. **Ehrle's New Preparation of Cotton for Stanching Hemorrhage.** American cotton of the best quality should be cleansed by boiling it for an hour in a weak solution of soda (about 4 per cent.), then repeatedly washed in cold water, pressed out, and dried. By this process it will be perfectly cleansed and adapted to more ready absorption. After this it should be steeped once or twice, according to the degree of strength required, in liquid perchloride of iron, diluted with ⅓ water, pressed, and thoroughly dried in the air—neither in the sun nor by the fire—then lightly pulled out. The cotton so prepared will be of a yellowish-brown color. It must be kept very dry, as it is affected by the damp.

5561. **Styptic Paper.** A mode for carrying about chloride of iron as a ready styptic has been invented in Paris, which consists in dipping paper in a decoction of 1 pound benzoin and 1 pound alum in 4 gallons water, which has been kept boiling for 4 hours, with renewal and skimming. The paper is left in the filtered solution for some time until saturated; it is then dried, and painted over with a neutral solution of perchloride of iron; this is then dried, folded, and wrapped in an impervious cover.

5562. **New Styptic Collodion.** Collodion, 100 parts; carbolic acid, 10 parts; pure tannin, 5 parts; benzoic acid, 5 parts. Agitate until the mixture is complete. This preparation, which has a brown color, leaves on evaporation a pellicle exactly similar to that of ordinary collodion. It adheres strongly to the tissues, and effects the instantaneous coagulation of blood and albumen. Tannin effects a consistent coagulation of the blood, whilst benzoic acid has a cicatrizing action on the tissues.

5563. **Spitting of Blood.** In cases of spitting of blood, it is often difficult to determine whether it proceeds from the internal surface of the mouth, from the throat, from the stomach, or from the lungs. When the blood is of a florid or frothy appearance, and brought up with more or less coughing, preceded by a short tickling cough, a saltish taste, anxiety, and tightness across the chest, its source is the lungs. The blood proceeding from the lungs is usually of a florid color, and mixed with a little frothy mucous only. It may be distinguished from bleeding from the stomach, by its being raised by hacking or coughing, and by its florid and frothy appearance; that from the stomach is vomited in considerable quantities, and is of a dark color.

5564. **Treatment for Spitting of Blood.** Moderate the discharge of blood by avoiding whatever tends to irritate the body and increase the action of the heart. A low diet should be strictly observed, and external heat and bodily exercise avoided; the air of the room should be cool, and the drink (which should consist chiefly of barley-water, acidulated with lemon-juice), taken cold, and the patient not suffered to exert his voice. After the operation of a little gentle aperient medicine, as lenitive electuary, or an infusion of senna, with a little cream of tartar dissolved in it, take 10 drops of laudanum and 10 drops of elixir of vitriol in half a cupful of cold water. If there is no cough, the laudanum may be omitted. A little salt and water given will often check spitting of blood, when it comes on. Put the feet in warm water, and give as above, the elixir of vitriol, &c. Give also ipecacuanha powder in small doses of from 1 to 2 grains every 4 hours.

5565. **Bleeding from the Nose.** This may be caused by violence, or may arise from an impoverished state of the blood. When it occurs in persons of middle age it is more serious, as it is then often a symptom of some other disease. The bleeding can generally be stopped by making the patient raise both his arms above his head, and hold them there for some time. Sponging with cold or iced water to the forehead and face, or applying a towel wet with cold water between the shoulders, will, in most cases, succeed. The application of a strong solution of alum or iron-alum to the inside of the nostrils, or plugging the nostrils with lint or cotton wool soaked in the solution, may be necessary if the bleeding is profuse. The health of persons subject to these attacks should be improved by nutritious diet, animal food, with potatoes, water-cresses, and fruit. The following prescription may be relied on: Tincture of steel, 2 drachms; dilute muriatic acid, 1 drachm; syrup of orange peel, 1 ounce; infusion of calumba, 7 ounces. Mix. For a child, 1 table-spoonful in a wine-glass of water before meals; for an adult the dose may be increased.

5566. **To Stop Bleeding at the Nose.** Placing a small roll of paper or muslin above the front teeth, under the upper lip, and pressing hard on the same, will arrest bleeding from the nose, checking the passage of blood through the arteries leading to the nose.

5567. **Astringent for Leech-Bites.** Dissolve 1 part of crystallized perchloride of iron in 6 parts of collodion very gradually. A drop or two of the product forms an admirable styptic.

5568. Antispasmodics. Medicines that allay spasms and other pains. Bark, opium, camphor, ether, musk, castor, assafœtida, valerian, and chalybeates, are antispasmodics.

5569. Nervines—sometimes called neurotics—are substances or agents which relieve disorders of the nerves. Antispasmodics, chalybeates, and vegetable tonics belong to this class.

5570. Treatment of Nervousness. The cure of nervousness is best effected by restoring the healthy action of the stomach and bowels, and by the use of proper exercise, especially in the open air. The stomach should not be overloaded with indigestible food, and the bowels should be occasionally relieved by the use of some mild aperient. Abernethy's injunction to a nervous and dyspeptic lady, "Dismiss your servants, madam, and make your own beds," should be recollected by all as a proof of the importance that eminent surgeon attached to exercise. Valerian is a medicine of great use in nervous disorders, hysteria, lowness of spirits, restlessness, and diseases of the bladder, &c. The common dose is from a scruple to a drachm, in powder; and in infusion from 1 to 2 drachms. Its unpleasant flavor may be neutralized by the addition of mace. Assafœtida is also recommended. Take assafœtida, 1½ drachms; water, 6 fluid ounces. Dose, 1 to 3 table-spoonfuls thrice or oftener, daily. But there is no remedy for nervous disorders of every kind, comparable to the proper and constant use of magnetic electricity.

5571. Nerve Powder. Take 1 ounce each of scullcap, valerian and catnip; and cayenne, 1 drachm; coriander seeds, ½ ounce. Pulverize, and mix. Take 1 tea-spoonful in a cupful of boiling water, leaving room for milk and sugar. Repeat according to the symptoms. This powder tranquillizes the most irritable nerves without debilitating and deadening their sensibility. It greatly strengthens the nerves.

5572. Nervous Mixture. Liquid carbonate of ammonia, ½ drachm; compound tincture of cardamom, ½ ounce; oil of lavender, 8 drops; mint water, 3 ounces; mix, and take in two or three doses. It is invaluable.

5573. Nervous Pill. Assafœtida, extract of hops, carbonate of ammonia, of each 1 ounce; extract of valerian, 20 grains. Dissolve the first two ingredients over the fire, then take off, and add the others; mix well, and with a few drops of the oil of lavender, and a little powdered liquorice, form into pills. Dose, 1 or 2 once or twice a day. Valuable in all nervous and hysterical disorders.

5574. Nervous Tincture. Compound tincture of bark, 2 ounces; ammoniated tincture of valerian, 1½ ounces; compound tincture of aloes, ½ ounce. Mix. Good for general weakness, low spirits, and nervous irritability. Two tea-spoonfuls twice a day. (*See No.* 5570.)

5575. Mixture of Valerian and Carbonate of Ammonia. An excellent remedy for nervous headache and depression of spirits. Mix 3 drops oil of valerian and 10 grains carbonate of ammonia with 1½ fluid ounces cinnamon water and ½ fluid ounce syrup. One-half to be taken every 4 hours.

5576. Remedy for Spasms. Take of acetate of morphia, 1 grain; spirit of sal-volatile and sulphuric ether, of each 1 fluid ounce; camphor julep, 4 fluid ounces. Mix. It should be kept closely corked, in a cool place, and should be well shaken before use. Dose, 1 tea-spoonful in a glassful of cold water or wine, as required.

5577. Hypochondriasis, or Low Spirits. Hypochondriasis, low spirits, or "blues," is a peculiar state of the mind, accompanied with indigestion. The principal objects of treatment are, to remove the indigestion, to strengthen the body, and to enliven the spirits; and one of the best plans with which we are acquainted for this is constant exercise and change of place, with a warm bath about thrice a week; early hours, regular meals, and pleasant conversation; the bowels being at the same time carefully regulated by the occasional use of a mild pill, and the stomach strengthened by some appropriate tonic medicine.

5578. To Dissolve Quinine. Sulphate of quinine (sometimes called simply quinine) when forming a part of a fluid mixture, must be dissolved in sulphuric acid before compounding with the other ingredients. In most of the fluid receipts which contain quinine, a small quantity of the acid is prescribed solely for this purpose; it should be added to the quinine drop by drop, and only sufficient used to make a perfect solution.

5579. Remedy for Fever and Ague. Peruvian bark, 2 ounces; wild-cherry tree bark, 1 ounce; cinnamon, 1 drachm, all pulverized; capsicum, 1 tea-spoonful; sulphur, 1 ounce; port wine, 2 quarts. Let stand a day or two. Always buy the Peruvian bark and pulverize it, as most ready pulverized articles are adulterated. This is the reason why more cures are not performed by it. Dose, a wine-glassful every 2 or 3 hours in the day until broken; then 2 or 3 a day until all is used. This mixture will be found an infallible cure for intermittent fever and fever and ague. It removes the disease when all other means fail, and may be used by those who object to quinine.

5580. Cure for Ague. To 5 tea-spoonfuls water, add 50 drops tincture of gelseminum and 10 grains quinine. Shake well before using. Administer 1 tea-spoonful in a wine-glass of sugar water every 2 hours. This medicine has a tendency to affect the head and vision, and produce physical prostration. When these symptoms become developed, cease the doses, and the effects will pass off, leaving the patient completely restored. These directions must be adhered to, as gelseminum, administered after its effects have become apparent, may be attended with serious consequences. (*See No.* 5578.) This is an excellent remedy.

5581. Dr. Krieder's Ague Pills. Take 20 grains quinine, 10 grains Dover's powder, (*see No.* 5176), 10 grains sub-carbonate of iron; mix with molasses or mucilage of gum-arabic, and divide into 20 pills. Dose, 2 each hour, commencing 5 hours before the chill should set in. Then take one night and morning until all are taken. (*See No.* 5584.)

5582. Quinine Mixture for Children. For small children nothing is better than 5 or 6 grains dissolved (*see No.* 5578) quinine in a 2-ounce vial, 1 table-spoonful of white sugar, then fill with water. Dose, 1 table-spoonful as above.

5583. Caution in the Use of Quinine. In all cases where quinine is to be administered, first give a cathartic to cleanse the stomach and bowels.

5584. Ague Mixture. Dissolve 20 grains quinine, mix it with 1 pint diluted gin or port-wine, and add 10 grains Dover's powder (*see No.* 5176), and 10 grains sub-carbonate of iron. Dose, a wine-glass each hour until the ague is broken, and then 2 or 3 times a day till the whole has been used. This is receipt No. 5581, in a liquid form. It may be used when the pills are objectionable.

5585. Remedy for Cold in the Head. Pollion, of France, recommends the inhaling of hartshorn for curing colds in the head. The inhalation by the nose he recommends 7 or 8 times in 5 minutes. Spirits of camphor may be used in the same manner with beneficial results.

5586. Catarrh. There is perhaps no complaint so common as catarrh, or cold in the head; it occurs both in winter and summer; and it is generally said that a summer cold is more difficult to get rid of than a winter one. The attack sets in with pains in the limbs and back, lassitude, and a sense of tightness across the forehead, repeated sneezing, watery and inflamed eyes, and increased discharge from the nose; sometimes there is inflammation of the throat and tonsils, and an eruption of vesicles about the lips.

5587. To Cure Catarrh. Remedies without number have been recommended for catarrh, but few are better than the old-fashioned plan—putting the feet into hot water, giving 10 grains of Dover's powder (*see No.* 5176) a hot drink, and plenty of blankets,

5588. Brown Mixture. Take powdered extract of liquorice and powdered gum-arabic, of each 2 drachms; hot water, 4 fluid ounces; mix, and add spirit of nitrous ether, 1 fluid drachm; antimonial wine, 2 fluid drachms; and tincture of opium, 40 minims. A table-spoonful for a dose. This is an excellent remedy in the early stages of catarrh; it is the well-known *compound liquorice mixture* of the Pharmacopœia.

5589. Flaxseed Tea. Macerate 1 ounce flaxseed and ½ ounce bruised liquorice root in 1 pint boiling water for 2 hours, in a lightly closed vessel; filter, and add 1 fluid ounce lemon juice. This is a good drink in cases of catarrh.

5590. To Relieve a Cough. The troublesome cough caused by an accumulation of phlegm in the throat, especially in the morning, experienced mostly by persons affected with chronic catarrh, can be relieved instantly by taking a tea-spoonful of the following mixture, which has also the advantage of being harmless to the stomach, rather improving the appetite. Put into an 8-ounce phial, ½ ounce muriate of ammonia and ½ ounce pulverized gum-liquorice; fill the phial nearly full with hot water, and shake thoroughly, to prevent the liquorice from becoming solid; shake also before using.

5591. Hay Fever. This very peculiar disease appears generally as a severe attack of catarrh, with asthmatic symptoms superadded. The lining membrane of the eyes, nose, throat, and lungs is all more or less affected. The patient suffers from headache, sometimes severe, sneezing, irritation of the nose and throat, with a dry harassing cough. The asthmatic attacks come on generally towards evening, and last from 1 to 3 hours, causing great distress. Hay fever is not a very common complaint, and only attacks those persons who, from some peculiarity of constitution, are susceptible to the causes producing it. It is supposed to be caused by the inhalation of the pungent aroma of spring grass and hay, but the inhalation of the powder of ipecacuanha will also produce it in certain individuals. In places where the rose is largely cultivated, similar attacks sometimes occur; it is then called *rose fever or rose catarrh.*

5592. Treatment of Hay Fever. The best treatment for hay fever is change of air, to the sea-side if possible. During the attacks, antispasmodics, such as sal-volatile, ether, or an emetic, if the patient is able to bear it, inhalations of hot steam medicated with creosote, carbolic acid, or turpentine, will be found useful. When the attack passes off the general health should be improved by tonics, diet, &c.

5593. Asthma. This disease is well known. It manifests itself in temporary fits of difficult breathing, is accompanied with wheezing, cough, a sense of suffocation, and constriction of the chest. The causes are, hereditary predisposition; cold and moist atmosphere; sudden changes of temperature; intense study; suppression of long accustomed evacuations; certain fevers; irritation of the air cells of the lungs; irritation of the stomach, &c. When this disease is attended with expectoration, it is called humoral asthma; and when there is no discharge it is named dry asthma. It is remarkable that what will excite the disease in one patient will often prove a means of relieving it in another.

5594. To Alleviate Asthma. For moderating the asthmatic paroxysm, no agent is more valuable in many cases than tobacco. A pipe often acts as a charm, and enables the patient to sleep and forget his troubles. In others, the wearing of a gauze veil over the face quite prevents the effects of the evil. It is most important to see that the bowels be freely opened at the commencement of an attack.

5595. Expectorants. Medicines that promote the secretion of the tracheal and bronchial mucus. According to Dr. Good, true expectorants are those medicines which rather promote the separation of the viscid phlegm with which the bronchiæ are loaded, than simply soften and dilute it; though these are also treated as expectorants by many writers. Numerous articles of the materia medica have been denominated expectorants, of which the following are the principal: Tartarized antimony, ipecacuanha, squills, garlic, assafœtida, ammoniacum, the oily resins, the balsams of tolu and Peru, benzoin, styrax, benzoic acid, the fumes of vinegar, tar, and of many of the volatile oils, and the smoke of tobacco and stramonium. Chlorine and ammoniacal gases have also been called expectorants. Medicines of this class are commonly employed in pulmonary complaints and affections of the air-tubes, attended by a vitiated state of the mucus, or an imperfect performance of the natural functions of the secretory vessels. (*Cooley.*) Of all classes of the materia medica, none are more uncertain in their action than expectorants. (*Pereira.*) The act of ejecting matter from the chest is called expectoration.

5596. Bronchitis. An inflammation of the mucous lining of the bronchia, or smaller ramifications of the windpipe. In its milder form it is commonly called a cold on the chest. The usual symptoms are hoarseness, dry cough, a slight degree of fever, followed by expectoration of mucus, at first thin, and afterwards thick and copious. In the severer forms there is more fever, cough, and oppression at the chest, &c. The generality of cases of bronchitis yield to small and repeated doses of ipecacuanha and antimonial diaphoretics, at the same time adopting a light diet, and keeping the bowels open with mild purgatives.

5597. How to Cure a Cold. Dr. G. Johnson, Professor of Medicine in King's College, London, in a recent lecture gives the following cure for a cold: On the whole, the plan which combines the greatest degree of efficiency with universal applicability, consists in the use of a simple hot-air bath, which the patient can have in his own bed-room. All that is required is a tin spirit lamp, with a sufficiently large wick, and holding sufficient spirit to burn for half an hour. The patient sits undressed in a chair with a lamp between his feet, rather than under the chair, care being taken to avoid setting fire to the blankets, of which an attendant takes two or three, and folds them around the patient from his neck to the floor, so as to inclose him and the lamp, the hot air from which passes freely around the body. In from a quarter to half an hour there is usually a free perspiration, which may be kept up for a time by getting into bed between hot blankets. Headache, pain in the limbs, and other premonitory indications of a severe cold, may be entirely removed in the course of half an hour by the action of the *hot-air bath.*

Another simple and efficient mode of exciting the action of the skin consists in wrapping the undressed patient in a sheet wrung out of warm water, then over this folding two or three blankets. The patient may remain thus packed for an hour or two, until free perspiration has been excited.

5598. Cough Pill. Extract of hyoscyamus, balm of gilead buds, with pulverized ipecacuanha or lobelia, and balsam of fir, of each ½ ounce; oil of anise a few drops, to form into common sized pills. Dose, 1 or 2 pills, 3 or 4 times daily. Dr. Beach says he endeavored for more than 25 years to obtain a medicine to fulfill the indications which are effected in this cough pill, particularly for ordinary colds and coughs; and this admirably answers the intention, excelling all others. It allays the irritation of the mucus membrane, the bronchial tubes, and the lungs, and will be found exceedingly valuable in deep-seated coughs and all diseases of the chest.

5599. To Cure a Troublesome Cough. 2 or 3 table-spoonfuls of linseed, a small bunch of horehound; boil to a jelly, and strain. Add ½ pound sugar candy, ¼ pound honey, ½ pound loaf sugar. First boil the horehound in 1 quart water, then add the strained linseed and the other articles. Simmer for 2 hours. When cold, add of chlorodyne, 3 table-spoonfuls. Bottle it and cork tight. A small quantity of spirits of wine or brandy to keep it. When the cough is troublesome, take a table-spoonful. This is an excellent remedy.

5600. Pulmonary Syrup. Blood-root, boneset, slippery elm bark, coltsfoot, elecampane, of each 2 ounces; white root, spikenard root, of each 4 ounces; comfrey root, poplar bark, of each 1 ounce; lobelia, horehound, snake-root, of each ½ ounce. Pour upon them 2 quarts of boiling water; stir well, add 1 pound molasses, and, when cool, 1 quart Holland gin. It is one of the best remedies for asthma, coughs, hoarseness, &c. A table-spoonful every hour, or a wine-glassful 3 times a day.

5601. Pulmonary Balsam. Horehound plant, comfrey root, blood root, elecampane root, wild cherry bark, spikenard root, penny-royal plant, of each 4 ounces. Pour 3 quarts boiling water upon them; infuse for 3 hours; then heat the water again, and pour it upon the plants to infuse 5 or 6 hours. Sweeten with sugar candy. It is very serviceable in diseases of the lungs, chronic coughs; it removes constriction of the chest by promoting expectoration. Take half a small tea-cupful 3 or 4 times a day, or oftener if necessary.

5602. Blood-Root Syrup. Bruised blood-root, 2½ ounces; lobelia, ¼ ounce; white sugar, 1½ ounces; water, 1½ pints; gently simmer half an hour, till it thickens; when cool, add a tea-spoonful of paregoric elixir. Take a table-spoonful occasionally; for a child, a tea-spoonful or less. This syrup is very valuable in chest complaints, bronchial affections, coughs, and difficult breathing.

5603. Cough Syrup. Tincture of lobelia, 1 ounce; Iceland moss, 2 ounces; white poppy capsules, bruised, 2 ounces; pearl barley, 2 table-spoonfuls; water, 2 quarts; molasses, 2 ounces. Boil down to 3 pints, and strain. Dissolve in it from 4 to 8 ounces of sugar candy. It effectually allays a tickling cough. A table-spoonful when the cough is troublesome. It does not constipate, like laudanum and paregoric.

5604. Cough Remedy. Take lobelia herb, horehound, boneset, of each 1 ounce; comfrey root, spikenard, St. Johns' wort, poppy capsules, of each ½ ounce. Infuse in 3 pints boiling water for 3 hours. Strain and add ½ pound loaf sugar boiled to a syrup. Add a wine-glassful of best rum. A table-spoonful is a dose. This is a valuable receipt for cough, hoarseness, &c.

5605. To Cure a Cold with a Cough. Make a decoction of the leaves of the pine tree, and sweeten with loaf sugar. Drink it freely, warm, before going to bed, and cold, through the day. It is a certain cure in a short time.

5606. Inhalation of Cubebs and Carbolic Acid. Mix together ½ fluid ounce tincture of cubebs and 20 drops liquid carbolic acid. Add the mixture to ½ pint hot water in an inhaler, and use every 3 or 4 hours, taking full respirations. A very efficient remedy in dry cough.

5607. Cough Mixture. Take muriate of morphia, ½ grain; glycerine, 2 fluid ounces. Mix. Dose, a tea-spoonful when the cough is troublesome.

5608. Treatment for Ulcerated Sore Throat. Chlorate of potassa, in cases of putrid ulcerated sore throat, has been used with the most decisive success. Its internal application more effectually allays thirst and abates fever than any other medicine; and, when applied as a gargle to inflamed or ulcerated sore throats, it has been found to disperse the inflammation and cleanse the ulcers more effectually than the infusion of rose-leaves with sulphuric acid, the gargle generally resorted to in those cases. The chlorate of potassa may be given in the dose of from 20 to 30 grains in a half glass of water, 3 or 4 times a day. For the purpose of gargling the throat, 4 drachms of the chlorate may be added to ½ pint of water. (*See No.* 5637.)

5609. Bell's Gargle for Syphilitic Sore Throat. Mix together 2 grains corrosive sublimate; 1 ounce rectified spirits of wine; 3 ounces tincture of Peruvian bark, and 1 ounce each honey of roses and tincture of myrrh.

5610. Atlee's Cough Mixture. 2 grains acetate of morphia; 1 drachm each tincture of belladonna and tincture of nux-vomica; 3 drachms each antimonial wine and syrup of ipecacuanha root; 1 ounce fluid extract of wild cherry bark, and 2 ounces syrup of balsam of tolu. A tea-spoonful 4 times a day relieves chronic or hacking cough.

5611. Hope's Cough Mixture. 2 ounces ammonia mixture; 5 ounces camphor mixture; 1 drachm tincture of digitalis (foxglove); ½ ounce each sweet spirits of nitre and syrup of poppies; 2 drachms solution of sulphate of morphia. A table-spoonful of this mixture is to be taken 4 times a day.

5612. Treatment of Consumption. It seems at first sight as superfluous to state that in a disease of debility like consumption, patients should breathe pure air, as that they should have good nourishing food, but it is not so. Theoretically, the value of pure air is accepted; but practically it is universally neglected. Healthful respiration has yet to be applied not only to every-day life, but in the treatment of disease. In ill health, and particularly diseases of the respiratory organs, the dictates of science and common sense are grossly outraged. If those persons who have consumption, or who have an inclination to it, would spend an hour every day in breathing pure air to the fullest extent to which their lungs are capable of taking it in, they would do more to prevent and cure this disease than it is possible to do by medication.

5613. Inhalation of Tar for Consumption. Mix together 16 ounces liquid tar and 1 fluid ounce liquor of potassa; boil them for a few minutes in the open air; then let it simmer gently in an iron vessel over a spirit or other lamp in the chamber of the patient. This may, at first, excite a disposition to cough, but in a short time allays it, and removes any tendency to it.

5614. Syrup of Blood-root. 1 ounce blood-root, ½ ounce aniseseed, and ½ ounce liquorice boiled in 2 pints water down to a pint, and then mixed with 4 ounces honey. This is highly recommended in consumptive cases attended with dyspeptic symptoms.

5615. Blood-root for Consumption. 25 to 40 drops saturated tincture of blood-root, taken 2 or 3 times a day, afford great relief.

5616. Cigars for Pulmonary Consumption. Dissolve 1 part arseniate of soda in 30 parts water. Dip white unsized paper into the solution and form into small rolls, 3 or 4 inches long. In pulmonary consumption inhale 4 or 5 whiffs as many times a day.

5617. Goddard's Cure for Loss of Voice. Wet bibulous paper with a solution of 1 part arsenite of potash in 25 parts water; dry and roll strips of 3 inches by 1 inch into cigarettes. The smoke to be inhaled, 8 or 10 inspirations, 3 times a day. In connection with this use 1/14 grain ammoniated mercury mixed with 10 drachms powdered sugar, apply a little to the throat with the end of the finger. This is an excellent remedy.

5618. To Cure Hoarseness. Saturated solution of iodine, 20 drops; alcohol, 1 ounce; 5 drops of the above on a lump of loaf sugar every two hours will be found invaluable.

5619. Cigars for Hoarseness, Asthma, &c. Soak thick unsized paper in a solution of saltpetre, and dry. Then brush over with tincture of cascarilla; and, when nearly dry, with compound tincture of benzoin. In about half an hour, cut it into pieces 1½ by 4 inches, and roll into cigarettes. Excellent for hoarseness, loss of voice, and asthma.

5620. Remedy for a Sudden Hoarseness. Mix 1 tea-spoonful of sweet spirits of nitre in a wine-glassful of water. This may be taken 2 or 3 times a day.

5621. To Prevent Hoarseness. A celebrated singer states that the greatest benefit is derivable from taking, during 5 or 6 days, twice a day, 5 or 6 drops of nitric acid in a glass of sugared water. If from use the acid loses its efficacy, the dose may be increased to 10 or 12 drops.

5622. Snuffles. A troublesome complaint, to infants especially. The mucous membrane of the nose, through the taking of cold, being much swollen, the child is no longer able to breathe through its nose, as it was accustomed to do, but is compelled to breathe through the mouth. The difficult breathings are attended by a peculiar snuffling noise, which, in sleep, becomes a regular loud snore. It often interferes with its sucking at the breast; as soon as it seizes the nipple a threatening suffocation compels it to desist. While this complaint lasts the child may be partially fed with the spoon; give it a very mild purgative; bathe its legs frequently in warm water. Rub the nose with tallow, and apply a slippery elm poultice mixed with cream.

5623. Influenza Mixture. Mix ½ ounce paregoric elixir, 1 ounce syrup of squills, and 2 drachms antimonial wine, with 6 ounces water. A tea-spoonful every 15 minutes until relieved.

5624. Treatment of Asthma. Relief is often obtained by smoking a pipe of tobacco. To a person unaccustomed to smoking, a pipe of latakia, or other mild description of tobacco; this soon produces exhaustion, while, directly the feeling of nausea comes on, the attack ceases. This remedy is often very useful in preventing an attack when one is impending. Stronger tobacco should be used by inveterate smokers. The fumes of burning filtering or blotting-paper, which has been soaked in a saturated solution of nitre, and dried, afford much relief in some cases (*see No.* 5619); and, lastly, there are instances where palliation is soonest obtained from a stimulant, as a glass of whiskey or brandy toddy, or a cup of very strong coffee. A mustard poultice over the front of the chest is often effective. Sometimes an attack may be arrested by taking off the patient's coat and vest, and exposing his back to the heat of a good fire. (*See No.* 5764.)

5625. Croup. This is a dangerous disease. It is common to infancy, and rarely occurs to adults. It is an inflammation of the larynx, trachea, and contiguous tissues. It derives its name from the peculiar sound of the voice and breathing, being of a whistling or crowing character, owing to a contraction of the glottis. It generally commences with a common cold and catarrh, hoarseness, cough, and increased difficulty of breathing, and the crowing already spoken of. It demands prompt treatment.

5626. Treatment of Croup. The great object is to diminish the inflammation and irritation, and to relax the spasmodic state of the muscles in the parts diseased. The vessels in those parts are overcharged with blood, by an imperfect action of the exhalants. Place the feet in warm water, and give an emetic. (*See No.* 5169.) After bathing, rub the legs and feet well with flannel. Then give a vapor bath, if the patient can bear it. Repeat the process, if needful. The perspiration will be greater by applying to the feet and each side hot bricks, and wrapped in flannel saturated with vinegar and a little water. At the same time give an aperient, to produce a free action on the bowels. Apply this tincture to the throat, viz.: ½ teaspoonful of cayenne pepper, nearly a cupful of vinegar; simmer 10 minutes, and strain. This tincture may be diluted with warm water, according to the strength of the patient. Rub it well on the throat for 5 or 10 minutes; and next saturate a flannel with it, and apply it to the throat. This application tends to relieve the internally congested blood-vessels. Repeat the application as necessary. Mustard plasters may be applied to the feet, the upper part of the chest, and between the shoulders alternately. Even a large sponge dipped in as hot water as the hand can bear, squeezed half dry, and renewed before it is cool, is of great advantage. It has been recommended to steep hops in hot vinegar, and the patient to inhale the vapor. Keep the atmosphere of the room at a regular temperature. Aid the perspiration by warm drinks, as balm tea, &c.

5627. Remedy for Croup. Turpentine is a sovereign remedy for croup. Saturate a piece of flannel with it, and place the flannel on the throat and chest, and in very severe cases 3 to 5 drops on a lump of sugar may be taken inwardly. Every family should have a bottle of turpentine on hand.

5628. To Prevent a Return of Croup. To prevent a return of this disorder, keep the child warm, avoid wet feet, cold, damp, easterly winds, &c. Children whose constitutions dispose them to croup ought to have their diet properly regulated, and be kept from all crude, raw, and trashy fruits.

5629. Mumps. This is a specific contagious inflammatory affection of the salivary glands, especially the largest, situated below the ear. It begins with slight feverish symptoms, with pain and swelling, extending from beneath the ear along the neck to the chin. The attack generally reaches its height in 4 days and then declines. The treatment is very simple—a mild diet, gentle laxatives, occasional hot fomentations, and wearing a piece of flannel around the throat.

5630. Quinsy. Inflammation of the tonsils, or common inflammatory sore throat, commences with a slight feverish attack, with considerable pain and swelling of the tonsils, causing some difficulty in swallowing; as the attack advances these symptoms become more intense, there is headache, thirst, a painful sense of tension, and acute darting pains in the ears. The attack is generally brought on by exposure to cold, and lasts from 5 to 7 days, when it subsides naturally, or an abscess may form in the tonsil and burst, or the tonsil may remain enlarged, the inflammation subsiding.

5631. Treatment of Quinsy. The patient should remain in a warm room, the diet chiefly milk and good broths, some cooling laxative and diaphoretic medicine may be given; but the greatest relief will be found in the frequent inhalation of the steam of hot water through an inhaler, or in the old-fashioned way, through the spout of a teapot. Relief will also be experienced from the following treatment: Roast 3 or 4 large onions. Peel them quickly, and beat them flat with a rolling-pin. Immediately place them in a thin muslin bag that will reach from ear to ear, and about 3 inches deep. Apply it speedily as warm as possible to the throat. Keep it on day and night, changing it when the strength of the onion appears to be exhausted, and substituting fresh ones. Flannel must be worn around the neck after the poultice is removed.

5632. Treatment of Whooping Cough. The attack generally begins as a common cold, with slight feverish symptoms. In 8 or 10 days the fever partially subsides, and the child gets attacks of convulsive coughing, accompanied by the peculiar whoop which gives the disease its name. The number of attacks varies from 1 or 2 to 10, or even 15 in the 24 hours, according to the severity of the disease. The child should be kept in a warm room. He ought to be clothed in flannel; his diet should be light and nourishing, such as fish, milk, light puddings, and new-laid eggs. The following prescription is strongly recommended by Dr. Valentine Mott: Hydrocyanic acid, 6 drops; extract of belladonna, 2 grains; paregoric elixir, 3 drachms; syrup of balsam of tolu, 1 ounce; and water, 3 ounces. Mix. 1 tea-spoonful 3 or 4 times daily. When the severity of the disease has passed off, change of air will be found most useful; and if the child has become debilitated, tonics, with nutritious diet, should be given. This disease being very infectious, great care should be taken to prevent communication of any kind with houses where there are children who have not already had whooping-cough.

5633. Syrup for Whooping-Cough. Onions and garlics, sliced, of each 1 gill; stew them in 1 gill sweet oil, in a covered dish, to obtain the juices; then strain and add honey, 1 gill; paregoric and spirits of camphor, of each ½ ounce; bottle and cork tight for use. Dose, for a child of 2 or 3 years, 1 tea-spoonful 3 or 4 times daily, or whenever the cough is troublesome, increasing or lessening, according to age.

5634. Atlee's Cure for Whooping-Cough. Take 1 drachm each powdered cochineal and strong aqua-ammonia; 1 ounce rectified spirits of wine. Mix. Dose for a child one year old, 10 drops in sweetened water 3 times a day.

5635. Cure for Whooping Cough. Pure carbonate of potassa, 1 scruple; cochineal, 1 grain; dissolve in 6 ounces of water sweetened with sugar. Dose for a child four years old, 1 tea-spoonful 3 times a day, to be taken before meals. This is an excellent remedy.

5636. Treatment of Diphtheria. Make two small bags to reach from ear to ear, and fill them with wood-ashes and salt; dip them in hot water, and wring them out so that they will not drip, and apply them to the throat; cover up the whole with a flannel cloth, and change them as often as they become cool, until the throat becomes irritated, near blistering. For children it is necessary to put flannel cloths between the ashes and the throat, to prevent blistering. When the ashes have been on a sufficient time, take a wet flannel cloth and rub it with castile soap until it is covered with a thick lather; dip it in hot water, and apply it to the throat, and change as they cool; at the same time use a gargle made of 1 tea-spoonful each of cayenne pepper, salt, and molasses, in a tea-cupful of hot water, and when cool, add ¼ as much cider vinegar, and gargle every 15 minutes, until the patient requires sleep. A gargle made of castile soap is good to be used part of the time.

5637. Remedy for Diphtheria. Permanganate of potassa has been administered with great success in cases of diphtheria. The proportions used for external use are 1 drachm of the permanganate to a pint of water; the dose for internal use, 1 tea-spoonful of a solution of 1 drachm in 1½ pints water. (*U. S. Dis.*)

5638. Remedy for Diphtheria. A gentleman who has administered the following remedy for diphtheria, says that it has always proved effectual: Take a tobacco pipe, place a live coal in the bowl, drop a little tar upon the coal, and let the patient draw smoke into the mouth, and discharge it through the nostrils. The remedy is safe and simple.

5639. Roche's Remedy for Diphtheria. M. Roche recommends the following mode of treatment. The false membranes are first freely cauterized with lunar caustic, and injections then made every hour against the fauces with a solution of common salt, the strength of the solution being such as not to create nausea. Chlorate of potassa may be also given internally; and tincture of iodine as a local application; but M. Roche considers that the irrigations with the solution of common salt are the chief agents in the case.

5640. Stiff Neck. Occasionally an attack is severe, and confinement to the house or bed, with wrapping up of the neck with cotton-wadding or flannel, together with attention to the state of the digestive powers, is necessary. The diet in these cases must be regulated, and an aperient, such as the lenitive electuary (*see No.* 5154), or castor oil, taken if required by the state of the bowels. If the stiffness be obstinate in its duration, it had better be rubbed with camphorated oil, or some other appropriate liniment.

5641. Anthelmintics. Medicines that destroy worms. Among the principal anthelmintics are santonin (worm-seed), calomel, tin powder, castor oil, oil of turpentine, cowhage, pinkroot, male-fern, and gamboge. A good plan for removing worms from children, is to give 3 to 5 grains of calomel in sugar, over-night, and a dose of castor oil the next morning. The motions should be observed, and if worms be found, the same treatment may be followed once a week, until they are wholly removed.

5642. Worms. The worms found in the human body are mostly the ascarides, the thread worm, infesting the lower intestine, causing much itching and irritation about the anus. The teres, or long round worms, are generally seated in the small intestines, and stomach. The symptoms denoting the existence of worms are common to the different species, viz.: indigestion, with a variable appetite; foul tongue; offensive breath; hard, full, and tense belly, with occasional gripings and pains about the navel; heat and itching sensation in the rectum and about the anus; the eyes heavy and dull; itching of the nose; short dry cough; grinding of the teeth; and starting during sleep, attended often with a slow fever.

5643. Dr. Freeman's Vermifuge Oil. Oil of worm-seed, ½ ounce; oil of turpentine, 2 drachms; castor oil, 1½ ounces; pink root, ½ ounce; hydrastin, 10 grains; syrup of peppermint, ½ ounce. Dose, for a child 10 years old, a tea-spoonful 3 times a day, 1 hour before each meal; if it purges too freely, give it less often. This is an excellent vermifuge, and never fails to expel worms when administered for that purpose. Where no worms are present, it answers the purpose of a tonic, correcting the condition of the mucous membrane of the stomach and bowels, and operating as a mild cathartic.

5644. Spackman's Worm Syrup. Take ½ ounce pink root; 2 drachms rhubarb root; 1 drachm worm-seed; ½ drachm savine leaves; 2 drachms colombo root, and 1 drachm cardamom seeds. Infuse these ingredients in ½ pint boiling water in a covered vessel; when cool, add ½ pint molasses and a table-spoonful brandy. Dose for a child 1 year old, 2 tea-spoonfuls 3 times a day.

5645. Remedy for Worms. Take 6 grains santonin; 2 grains powdered gamboge; 3 grains calomel; and 12 grains powdered white sugar. Make into 6 powders. Give 1 powder 3 times a day for a child one year old, and a dose of castor oil the day after taking the powders.

5646. Oil of Worm-seed Mixture. Take 1½ fluid drachms oil of worm-seed, 3 ounces castor oil, and 10 drops oil of anise; mix them together, and add 1 fluid ounce aromatic syrup of rhubarb. Shake well before using. Dose for a child of 2 years, 1 tea-spoonful night and morning.

5647. A Simple and Safe Vermifuge. Powdered rust of iron is a good vermifuge. It expels the worms and strengthens the constitution. To a child 6 years old from 10 to 40 grains may be given. An adult may take ¼ ounce or more. It may be given in molasses or in beer. Dr. Rush says that he knows of no safer and more certain remedy than this simple preparation of iron. It should always be followed by an aperient.

5648. Worm Pills. Ethereal extract of male-fern, 30 drops; extract of dandelion, 1 drachm; powdered gum enough to make 30 pills. Dose, from 6 to 20; followed half an hour later by a strong dose of castor oil.

5649. Tape-Worm. The common male-fern root is a certain remedy for the tape-worm. 2 or 3 drachms of the powdered root to be taken in the morning, no supper having been taken the night before. It generally sickens a little. A brisk purgative is to be given a few hours after, which sometimes brings off the worm entire; if not, the same course must be followed at due intervals. For the success of this remedy, the root should be recently gathered; as, after being kept long in the stores, its activity is diminished or destroyed.

5650. Dowler's Treatment of Tape-Worm. Dr. Dowler expelled a tape-worm 135 feet long by prescribing the continued use of elm-bark. He ordered the bark to be chewed and swallowed in moderate quantities.

5651. Beach's Treatment of Tape-Worm. Dr. Beach effectually cured a patient who had been tormented with a tape-worm for 25 years. His treatment was as follows: Cowhage stripped from the pod, a small tea-spoonful 3 times a day; to be taken, fasting, in a little arrow-root jelly; then occasionally a purgative of mandrake. In connection with this, eat freely of garlic and fine common salt. This treatment is to be continued until the tape-worm is killed or so sickened that it will lose its hold on the bowels, when it will be expelled entire. When once the tape-worm begins to pass the bowels, care must be taken not to break it off, for it will then grow again; it has this peculiar property.

5652. Diarrhea. The following excellent remarks on this disease are extracted from Dr. Hall's Journal of Health: Cholera is nothing more than exaggerated diarrhea. It may be well for travelers to know that the first, the most important, and the most indispensable item in the arrest and cure of looseness of the bowels, is absolute quietude on a bed; nature herself always prompts this by disinclining us to locomotion. The next thing is, to eat nothing but common rice, parched like coffee, and then boiled, and taken with a little salt and butter. Drink little or no liquid of any kind. Bits of ice may be eaten and swallowed at will. Every step taken in diarrhea, every spoonful of liquid, only aggravates the disease. If locomotion is compulsory, the misfortune of the necessity may be lessened by having a stout piece of woolen flannel bound tightly round the abdomen, so as to be doubled in front, and kept well in its place. In the practice of many years, we have never failed to notice a gratifying result to follow these observances.

5653. Velpeau's Remedy for Diarrhea and Cholera Morbus. Take 1 ounce each tincture of opium, paregoric elixir, and tincture of rhubarb; 10 drachms essence of peppermint; and 6 drachms tincture of capsicum. This is the original receipt for this celebrated remedy. Dose for an adult, a tea-spoonful in ½ a wine-glass sweetened water; and, if required, half a dose after each loose evacuation.

5654. Diarrhea Tincture. Compound tincture of myrrh, 6 ounces; tincture of rhubarb, and spirits of lavender, of each 5 ounces; tincture of opium, 3 ounces; oils of anise and cinnamon, with gum camphor and tartaric acid, of each ⅛ ounce. Mix. Dose, 1 tea-spoonful in a little warm water sweetened with loaf sugar; repeat after each passage. This is a magic remedy.

5655. Chlorodyne Mixture. Shake together 2½ fluid drachms each chlorodyne and rectified spirit; add 1 fluid ounce syrup, and shake again well; then add a little at a time, with brisk agitation, 4 fluid ounces distilled water and 3 fluid drachms mucilage. Dose, 1 to 2 table-spoonfuls in diarrhea, cholera, &c. Shake well before using.

5656. Goddard's Diarrhea Remedy. Dr. Paul Goddard gives the following remedy: Take ½ ounce tincture of catechu, 2 drachms each tincture of opium and tincture of camphor, and 1 drachm aromatic spirits of ammonia. 40 drops every hour will afford speedy relief.

5657. Remedy for Diarrhea. Tincture of opium, spirits of camphor, essence of peppermint, ethereal tincture of capiscum, of each ½ ounce; syrup of kino, 1 ounce; neutralizing cordial, 2 ounces (*see No.* 5633); brandy, 2 ounces. Mix. Dose, one table-spoonful, may be given every twenty minutes if the case is urgent. In dysentery give 1 table-spoonful 3 times a day. This is an excellent remedy.

5658. Blackberry Cordial. To 1 quart blackberry juice, add 1 pound white sugar, 1 table-spoonful each cloves, allspice, cinnamon, and nutmeg. Boil all together 15 minutes, add a wine-glass of whiskey, brandy, or rum. Bottle while hot, cork tight and seal. This is almost a specific in diarrhea. Dose is 1 wine-glassful for an adult, half that quantity for a child; will often cure diarrhea. It can be taken 3 or 4 times a day if the case is severe.

5659. Remedy for Summer Complaint. A tea made of the seeds of the sunflower, roasted like coffee berries, is an admirable remedy for all species of summer complaint. ½ pint of the seed is sufficient. It should be remembered, however, that serious results often follow the too sudden stoppage of diarrhea by astringents, and with this, as all remedies of a similar nature, caution should be used.

5660. **Remedy for Bilious Diarrhea.** Infuse ½ ounce Angostura bark for 2 hours in 1 pint boiling water, and strain; is a remedy for bilious diarrhea, especially in southern latitudes.

5661. **Treatment of Diarrhea in Infants.** Dr. Smith recommends the following prescriptions, if the bowels are rather loose, with dark, slimy, offensive stools. Tincture of opium, 8 minims; castor oil, 1 drachm; syrup of ginger and mucilage of acacia, each 1 ounce. A tea-spoonful 3 times daily. In the screaming fits, accompanied by constipation, this combination of castor-oil with laudanum is very valuable. (*Med. News.*)

5662. **Treatment of Cholera.** The following excellent directions are given for the treatment of cholera by Dr. Pratt: For the *stage of diarrhea.* This may come on insidiously, painless, and hence not alarming, but should be met promptly. The remedy is the cholera mixture, so called, consisting of equal parts of laudanum, tincture of rhubarb, and spirits of camphor. Begin with 30 drops, taken clear and unmixed, with a little sugar placed in the mouth afterward. Repeat the dose after every evacuation, increasing it if the case becomes urgent to 60 drops (a tea-spoonful), or 90 drops if necessary. If the diarrhea is not controlled by this means, an injection of from 30 to 90 drops laudanum, in a table-spoonful of starch, will prove a valuable help. This may be often repeated. If the diarrhea ceases, do not entirely intermit the medicine, but give in gradually diminished doses, every 1 or 2 hours, for a period of 12 or even 24 hours.

5663. **Treatment for the Vomiting Stage.** Dr. Pratt's remedy is laudanum, tincture of capsicum, tincture of ginger, and tincture of cardamom seeds, equal parts; to be given from 40 to 60 drops undiluted, and followed by sugar, after every fit of vomiting; taking care to give it as soon as the fit ceases, when it will be more likely to be retained. An excellent assistant to this is a large mustard poultice applied to the abdomen.

5664. **Treatment for the Stage of Malignancy.** According to Dr. Pratt, the only remedy is stimulants, especially brandy, which must be given with great freedom, from 2 to 4 tea-spoonfuls every half or even quarter hour, till heat returns, and pulse and sensibility of extremities are restored. It is always to be given undiluted. Alcohol, or other spirits, will answer the purpose, if brandy is not to be had. It will be necessary to combine with this, artificial heat, bottles of hot water to the body and extremities, friction of the limbs (which no one need fear to apply), and mustard, perhaps, to the feet and hands, stomach and limbs. Remember that boldness, to the verge of rashness, is better than excess of caution, and that no danger is to be apprehended from any of these remedies so long as the symptoms for which they are given are uncontrolled. The use of cold water must be strictly forbidden, except merely to gargle the throat; a very small quantity, swallowed, will bring on the diarrhea after it has been stopped for hours. A little water of gum-arabic may be allowed, a tea-spoonful at a time; or, perhaps, lumps of ice might be taken with safety. For the typhoid fever, which often follows an attack, chamomile or sage tea, and diaphoretic (*see No.* 5134) treatment, will be all that is needed, beside a moderate use of stimulants, for convalescence.

5665. **Cholera Preventive.** A Burgundy-pitch plaster worn over the region of the stomach during the prevalence of the disease. It should be warmed a little before it is put on, the person standing erect when it is applied, so that the plaster shall not interfere with the motions of the body. It is asserted that a British regiment supplied with such plasters lost only five men during a severe visitation of cholera, and these had refused to wear then. The efficacy of this preventive is also corroborated by other well-authenticated evidence.

5666. **Neutralizing Mixture.** Powdered rhubarb, 3 scruples; saleratus, or crude bicarbonate of potash, 3 scruples; powdered peppermint plant, 3 scruples; boiling water, ½ pint; decoction of aniseed, ½ pint. Mix. Strain, sweeten with sugar, and add 3 table-spoonfuls of brandy. Take 1 or 2 table-spoonfuls as often as the symptoms require it. For children, a less dose. Very valuable in cholera, bowel complaints of children, laxity of the bowels, flux, &c.

5667. **Spackman's Cholera Mixture.** Take 1 ounce gum camphor; 2 ounces gum kino; ½ ounce gum catechu; 2 ounces ground cinnamon; 1 ounce ground cloves; 2 drachms African capsicums. Moisten these with brandy and digest for 48 hours. Displace (*see No.* 41) 18 ounces; then add 20 drachms tincture of opium and 1 ounce chloroform. Dose for an adult, 60 drops after every passage.

5668. **Brown's Cholera Mixture.** Mix together 1 ounce essence of Jamaica ginger; 2 ounces each camphorated tincture of opium and aromatic spirits of ammonia; and 1 ounce spirits of camphor. Dose, a tea-spooonful every hour.

5669. **Troth's Cholera Mixture.** Digest for 10 days 1 ounce each opium, camphor, oil of cloves, and African capsicums, in 1 pint Hoffman's anodyne (*see No.* 4749); administer 20 to 40 drops every 2 hours.

5670. **Austrian Cholera Specific.** Take 20 grains sulphuric acid specific gravity 1.500; 15 grains each sugar and gum; distilled water sufficient to make the whole weigh exactly 1 ounce. 1 table-spoonful of the above mixture is to be taken in water on the first appearance of premonitory symptoms, followed by the free use of ice-cold water. A second dose ½ an hour after is generally sufficient to arrest the disease, but occasionally 4 or 5 doses are required. A table-spoonful in a pint of cold water may afterwards be drunk as often as desired. When collapse sets in, double doses are to be given, and repeated after every attack of vomiting, until the sickness and cramp abate. After which, the doses are to be repeated until 5 or 6 doses are retained by the stomach. Quiet sleep or drowsiness should not be interfered with. The free use of cold water or acidulated water is to be allowed until perspiration sets in and the warmth of the body returns. The use of warm drinks, wine, spirits, &c., are to be carefully avoided as so much poison. The above was adopted by the Austrian Government in 1849, after 18 years' successful trial.

5671. **Homœopathic Cholera Preventive.** Dissolve 1 drachm camphor in 6 drachms rectified spirit, and preserve it in a well-corked bottle. Dose, 2 drops on a lump of sugar 2 or 3 times a day.

5672. **Homœopathic Cholera Remedy.** Repeat the dose of the mixture in foregoing receipt every 10 or 15 minutes, followed by draughts of ice-cold water until the symptoms abate.

5673. **Use of Calomel in Cholera.** When cholera is prevailing, a single large, thin, painless, weakening action of the bowels may be cholera begun, and the business man should start for home in a vehicle instantly, calling on his physician on his way, and take him home with him; or, if he cannot be found immediately, get into bed as soon as possible, dress up warm, eat ice if thirsty, bind a thick warm flannel tightly around the abdomen, and wait for his doctor's arrival. A physician should be called always on the instant of an attack, but when it is impossible to procure his services within an hour, 10 or 20 grains of calomel should be taken in pill or powder, as a means of stopping the discharges, and of thus arresting the disease, until the physician arrives. Calomel is generally easy to be procured, will remain on the stomach, from its heaviness, when even cold water is ejected as soon as swallowed, and is the most certain of all medicines known to stimulate the liver to action, this want of action being the fundamental cause of the disease. (*Hall.*)

5674. **Cholera Tincture.** Tinctures of rhubarb, cayenne, opium, and spirits of camphor, with essence of peppermint, equal parts of each, and each as strong as can be made. Dose, from 5 to 30 drops, or even to 60, and repeat until relief is obtained, every 5 to 30 minutes. Many lives have been saved by the timely use of this valuable medicine.

5675. **Treatment of Dysentery.** A slight attack will often yield to the employment of a dose of castor oil; warm fomentations or mustard poultices being applied over the belly; the patient being confined to bed, and only allowed to partake of food the most simple in its nature, that is, farinaceous food, cream, or milk (with one-third of lime-water, if requisite), thin broths, &c. Perfect rest in the horizontal posture is almost essential. A warm bath for 20 minutes, or a shorter time if the patient feels faint, will often give great relief. Stimulants should be forbidden in mild cases; but where the patient is becoming weakened by the disease, port wine, as the best stimulant in these cases, may be given in beef-tea, or alone. And the rule of little and often may be strictly observed. Early treatment is most important in dysentery, and therefore the medical man should be sent for without loss of time, in case the simple means recommended are ineffectual.

5676. **Indian Cure for Dysentery.** In diseases of this kind, the Indians use the root and leaves of the blackberry bush, a decoction of which in hot water, well boiled down, is taken in doses of a gill before each meal, and before retiring to bed. It is an almost infallible cure.

5677. **Simple Remedy for Dysentery.** The following simple remedy has been known to cure the most obstinate and malignant forms of dysentery when all the ordinary methods were ineffectual: Take hot water, 1 gill; vinegar, ½ pint; mix; then continue to add common salt as long as it will be dissolved, stirring and irritating it freely and frequently. Give for an adult 1 table-spoonful every hour until the bloody discharges cease, or until it operates freely on the bowels. The patient must remain in bed.

5678. **Antacids.** Medicines that neutralize the acid of the stomach, and thus tend to remove heartburn, dyspepsia, and diarrhea. The principal antacids are the carbonates of potassa, soda, ammonia, lime, and magnesia. Ammonia is the most powerful, and when the acidity is conjoined with nausea and faintness, is the best; when great irritability of the coats of the stomach exist, potash is preferable; when accompanied with diarrhea, carbonate of lime (prepared chalk); and when with costiveness, magnesia. The dose of the carbonates of potassa and soda in powder is half a tea-spoonful; of chalk, a teaspoonful; of magnesia, a dessert-spoonful; and of carbonate of ammonia, 10 grains, or a teaspoonful of the solution. All these are taken in water.

5679. **Dyspepsia.** If a man wishes to get rid of dyspepsia, he must give his stomach and brain less to do. It will be of no service to follow any particular regimen—to live on chaff bread or any such stuff—to weigh his food, etc., so long as the brain is in a constant state of excitement. Let that have proper rest, and the stomach will perform its functions. But if he pass 10 or 12 hours a day in his office or counting-room, and take no exercise, his stomach will inevitably become paralyzed; and if he puts nothing into it but a cracker a day, it will not digest it. In many cases it is the brain that is the primary cause. Give that delicate organ some rest. Leave your business behind you when you go to your home. Do not sit down to your dinner with your brows knit, and your mind absorbed in casting up interest accounts. Never abridge the usual hours of sleep. Take more or less of exercise in the open air every day. Allow yourself some innocent recreation. Eat moderately, slowly, and of just what you please. If any particular dish disagrees with you, however, never touch it or look at it. Do not imagine that you must live on rye bread or oat meal porridge; a reasonable quantity of nutritious food is essential to the mind as well as the body. Above all, banish all thoughts of the subject. If you have any treatises on dyspepsia, domestic medicines, etc., put them directly out of your reach. If you are constantly talking and thinking about dyspepsia, you will surely have it. Endeavor to forget that you have a stomach. Keep a clear conscience; live temperately, regularly, cleanly; be industrious, too, but avoid excess in that, as in all other things.

5680. Artificial Digestion. A London physician, Dr. Marcet, has announced a process by which natural digestion is imitated by artificial means, and solid food may thereby be prepared for invalids. Dr. Marcet takes 58 grains muriatic acid having a specific gravity of 1.1496; 15 grains of pepsin—the organic principle procured from the stomach of a pig or other animal. Diluted in a pint of water and added to a pound of raw meat, the whole is allowed to simmer over a water-bath at about the temperature of the body, 98° Fahr. When the meat is by this means sufficiently broken up, it is strained, and the acid neutralized by 81 grains of bicarbonate of soda. The product is of a most agreeable character, easily digested and vastly more nutritious than beef tea. Where pepsin cannot be obtained, the doctor has found strips of calves' stomach answer very well.

5681. Dick's Cure for Dyspepsia. Mix together ½ ounce bicarbonate of soda; 2 drachms aromatic spirits of ammonia; 6 drachms compound tincture of gentian; 6 drachms tincture of henbane; 2 drachms tincture of ginger; 3 drops creosote; ½ ounce ginger syrup, and 3 ounces water. A tablespoonful taken after each meal will cause a speedy cure.

5682. Dick's Dyspepsia Pills. Make the following ingredients into 40 pills: 2 scruples each compound extract of colocynth, and compound rhubarb pill (*see No.* 4923); 1 scruple blue mass (*see No.* 4919); 55 grains soap; 1 drachm extract henbane; 3 drops oil of cloves. Take 2 pills at bed-time.

5683. Spackman's Anti-Dyspeptic Pills. Make into a mass, 6 drachms 24 grains powdered aloes; 3 drachms 20 grains each gamboge, scammony, and compound extract of colocynth; 96 grains soap; 15 drops each oil of caraway and oil of anise; with 1 drachm water. Divide the mass into 16 parts, and make each part into 24 pills; 384 pills altogether. A dose consists of 3 pills.

5684. Absorbents are medicines administered to counteract acidity in the stomach or intestinal canal. In most cases, emetics and aperients are given previous to their being taken; they are carbonate of ammonia, in doses of from 5 grains to 1 scruple; liquor of ammonia, 10 to 20 drops; aromatic spirit of ammonia, 20 to 30 drops; lime water, 2 ounces to ½ pint; magnesia, calcined, 20 to 40 grains; carbonate of magnesia, ½ to 2 drachms; carbonate of potassa, 10 grains to ½ drachm; carbonate of soda, 10 grains to ½ drachm; soda water, ½ pint. (*See No.* 5678.)

5685. To Correct Acidity of the Stomach. The neutralizing mixture (*see No.* 5666) is very effectual in curing this disorder. Or, 10 grains of calumba, powdered, and 10 grains of magnesia, well mixed. Magnesia and a little finely powdered chalk will be of great service.

5686. Remedy for Acidity of Stomach. This is a common symptom of weak or disordered digestion, and should be treated with small doses 3 or 4 times daily of the carbonate or bicarbonate of potassa, soda, or ammonia; or of sal-volatile or ammonia water, to which some tonic bitter may be added. Diet should be light and nutritious, with as much out-door exercise as possible. The bowels should be kept regular by the occasional use of some mild aperient.

5687. Carminatives. Medicines that allay flatulency and spasmodic pains. Among the principal carminatives are aniseed, caraway-seed, cardamoms, cassia, cinnamon, ginger, peppermint and the peppers; including ardent spirits and most aromatic essences and tinctures.

5688. Flatulency in Children. It often arises from a mother's impure milk; when it is so she must take the neutralizing mixture (*see No.* 5666); and if not effectual, administer it to the infant. Also foment the stomach with warm brandy and water, to which add a little salt. Give also the carminative drops. (*See No.* 5689.)

5689. Carminative Drops, for expelling wind. Angelica, 2 ounces; lady's slipper, 1 ounce; sweet flag, ¼ ounce; anise, 1 ounce; fennel seed, ½ ounce; catnip flowers, 1 ounce; mother-wort, 1 ounce; pleurisy root, 2 ounces. Infuse in a pint of spirits of wine for 3 or 4 days, often shaking, keeping it in a warm place; then add a pint of water and a tablespoonful of tincture of cayenne. Excellent in flatulency, colic, nervous affections, promoting perspiration and refreshing sleep.

5690. Heartburn. Anxiety and pain about the region of the stomach, generally attended by a sense of gnawing and heat; hence called heartburn. Faintness, nausea, and eructation of a thin, acidulous, watery liquid, especially in the morning, are common symptoms of this complaint. The usual causes of heartburn are excess in eating or drinking, the use of improper food, and sedentary habits. A good remedy is a tea-spoonful of carbonate of magnesia, or carbonate of soda, in a glass of peppermint or cinnamon water, to which a little powdered ginger may be added with advantage. This dose may be taken 2 or 3 times daily until the disease is removed. Articles of food that easily undergo fermentation should at the same time be avoided, and a dry diet had recourse to as much as possible. Soda-water, toast and water, and weak spirits and water, are the most suitable beverages in this complaint.

5691. To Cure Water-Brash. When there is a tendency to confined bowels, some aperient must be administered occasionally until proper dieting, &c., renders it unnecessary. Fluid magnesia, or the lenitive electuary (*see No.* 5154), will probably be all that is necessary. The diet must be carefully attended to in all cases; and as the disorder often arises from the use of innutritious or unwholesome food, the adoption of a more varied and generous diet, including a sufficient proportion of meat, is essential to the permanent success of any remedy.

5692. Treatment of Colic. Let it be remembered that colic may occur as the prelude to an inflammatory attack; and that if neglected or unskillfully treated, such tendency is very considerably increased. In the treatment of colic, very great advantage results from the external application of warmth; hot fomentations, bags of hot salt or bran, or flannel wrung out of turpentine, or mustard poultices, should be diligently employed. While these means are being used, a dose of laxative medicine should be administered;

for, as in the great majority of cases of colic the pain depends on some obstruction in the bowels—very likely on the presence in them of some deleterious and indigestible food, &c.—it is of essential importance that free passage should be obtained as speedily as possible. A full dose (1½ ounces) castor oil, is a safe and good medicine for the purpose; to be repeated in 2 or 3 hours if there has been no action of the bowels. If the medical man has arrived meanwhile, he will very likely order some stronger medicine, as, if the oil has not acted, steps must be taken to clear the bowels as soon as possible. If the pain is very severe, a tea-spoonful of powdered ginger, or a little cayenne pepper may be added to the oil or taken after it. When free action of the bowels is obtained, the pain soon ceases. After such attacks great caution is requisite in the matter of diet for some time; only the plainest and most digestible food being taken.

5693. Treatment of Lead or Painters' Colic. In cases of colic arising from poisoning by lead, called lead colic, so often experienced by plumbers, painters, workers in shot towers, &c., the great object is to obtain free action of the bowels, as in common colic; and medical assistance should be obtained at once. Of course every care should be taken to prevent any further entrance of lead into the system. In order to obviate the occurrence of lead-poisoning in those who are of necessity exposed in a greater or less degree to its influence, frequent ablutions of the hands and surface of the body should be practiced; while sulphuric acid lemonáde should be used as a beverage.

5694. Fainting Fits. If a person faints, let him be placed on his back until he comes to. Do nothing else. He has fainted because the heart has stopped beating. It will come to of itself as soon as nature desires it, and it will be easier to propel the blood in a horizontal direction, when lying down, than perpendicularly to the head, chest, and arms, when sitting up. And yet the very first effort of bystanders when a person is observed to have fainted, is to place him on a chair, or lift up his head. (*Hall*). If the patient be a female, place her on her back, with the head low, loosen all clothes about the neck and chest, sprinkle cold water on the face, and apply smelling salts to the nostrils. When the patient can swallow, give some cold water, with 20 or 30 drops of sal-volatile, or a little brandy.

5695. Fits. If a person falls in a fit, let him remain on the ground, provided his *face be pale;* for should it be fainting or temporary suspension of the heart's action, you may cause death by raising him upright, or by bleeding; but if the *face be red or dark colored*, raise him on his seat, throw cold water on his head immediately, and send for a surgeon, and get a vein opened, or fatal pressure on the brain may ensue.

5696. Cure for Cramps. Mix 2 drachms chloroform, 1 drachm oil of camphor, 6 drachms mucilage of gum-arabic, and 1½ grains acetate of morphia. Dose, 40 drops every 2 hours.

5697. Remedy for Dropsy and Liver Affections. Mix 8 ounces infusion of dandelion (taraxacum); ½ ounce extract of dandelion; 2 drachms carbonate of soda; 6 drachms tartrate of potassa; 8 drachms tincture of rhubarb; 1½ ounces tincture of henbane. Dose, a table-spoonful every 2 hours.

5698. Cure for Liver Complaint. Take ½ ounce each extract of taraxacum (dandelion) and tartrate of potassa; 45 grains carbonate of soda; ½ ounce sweet tincture of rhubarb, and 6 ounces spring water. Dose, a tea-spoonful 3 times a day.

5699. Remedy for Liver Complaint. Mix ½ ounce each fluid extract of rhubarb and of senna with 4 ounces water. Then add ½ ounce extract of taraxacum; 3 drachms acetate of potassa; ½ ounce compound tincture of gentian; and 1 drachm muriatic ether. Dose, a table-spoonful 3 times a day.

5700. Dandelion Pills. Take 30 grains extract of dandelion, and 6 grains calomel; make into 10 pills. 2 taken 3 times a day are a useful remedy for dropsy in the belly arising from disorder of the liver. (*See No.* 5697.)

5701. Infusion of Dandelion. Steep 2 ounces bruised dandelion root in 1 pint boiling water. After 24 hours strain. 2 tablespoonfuls 4 times a day is a remedy for dropsy. (*See No.* 5697.)

5702. Sick Headache. This usually proceeds from acidity and overloading the stomach. When it is not from improper eating, all that is necessary is to soak the feet in hot water for 15 minutes, drink some warm herb tea, retire to bed, and take a good sweat for about an hour. This will give relief. If the trouble arises from over-eating, relief may be obtained by taking an emetic. (*See No.* 5169.)

5703. Periodical Sick Headache. Those who are afflicted periodically with sick headache, accompanied with nausea and sometimes with vomiting, may obtain relief by soaking the feet in hot water, and using the emetic directed in No. 5169. This treatment should be followed by taking the lenitive electuary. (*See No.* 5154.)

5704. Nervous Headache may be relieved by using one of the evaporating lotions. (*See No.* 4843.) An application of the "Good Samaritan" is also very effectual. (*See No.* 4858.) Any of the remedies under the head of neuralgia are also recommended for severe attacks. (*See Nos.* 5544, *&c.*)

5705. To Relieve Nervous Headache. From 10 to 20 drops sal-volatile (aqua ammonia) in ½ wine-glass of water will frequently give relief; a dose of 10 drops, and repeated at intervals of 10 minutes, seldom fails.

5706. Remedy for Sick Headache. It is stated that 2 tea-spoonfuls of finely powdered charcoal, drank in half a tumbler of water, will give immediate relief to the sick headache, when caused, as in most cases it is, by too much acid on the stomach. This remedy has been highly recommended. (*See also Antacids, No.* 5678.)

5707. Bisulphide of Carbon a Remedy for Headache. Dr. Kennion thus describes the mode of application of this remedy: A small quantity of the solution (about 2 drachms) is poured upon cotton-wool, with which a small wide-mouthed glass-stoppered bottle is half filled. This, of course, absorbs the fluid; and, when the remedy has to be used, the mouth of the bottle is to be applied closely (so that none of the volatile vapor may escape) to the temple, or behind the ear, or as near as possible to the seat of pain, and so held for from 3 to 5 minutes. After it has been applied for a minute or two, a sensation is felt as if several leeches were biting the part; and, after a lapse of a few minutes more, the smarting and pain become rather severe, but subside almost immediately after the removal of the bottle. The effect of this application is generally immediate. (*British Med. Journ.*)

5708. Simple Remedy for Piles. Take fresh white pine pitch in pills, from 12 to 20 a day, and sit in a tub of cold water 4 or 5 times a day, 30 minutes each time, for a month. A very obstinate case of piles was cured by this treatment.

5709. Internal Remedy for Piles. Pulverize in a mortar and mix thoroughly, 1 ounce each of cream of tartar, jalap, senna, flowers of sulphur, and golden seal, and ½ ounce saltpetre. Dose, a tea-spoonful 3 times a day.

5710. External Remedy for Piles. Boil some of the inner bark of white oak in water, and strain; evaporate to a thick extract. To ½ pint of this extract, add ½ pint of oil rendered from old, strong bacon. Simmer together till mixed, and let it cool. Apply with the finger inside the rectum every night and until cured.

5711. Persulphate of Iron for Piles. An ointment made of ½ drachm persulphate of iron, and 1 ounce simple salve, has been found especially beneficial in cases of ulcerated hemorrhoid. Dr. Geo. S. Cartwright describes a case of hemorrhoid in which there was an external tumor of the size of a large pea, protruding, at certain times, to the size of a walnut. He applied lead water freely to the part, with an application of this salve before the patient retired at night, and the effect was almost immediate, relieving the pain and cauterizing the part. The effect of this salve is permanent. The same physician occasionally uses the ointment with double the above proportion of the persulphate.

5712. Treatment for Irregular Menstruation, or Monthly Flow. Where the flow is absent, or irregular. The treatment of cases of this kind should embrace every possible means of improving the general health, particularly the enjoyment of pure air, and the use of the shower or hip-bath; moderate exercise, especially on horseback; with a wholesome nutritious diet. The medical treatment must not be trifled with, as it requires considerable watching; it should therefore be carried out under the eye of a skillful physician. When the slightest appearance of menstruation takes place, the patient should be kept as quiet as possible; and, in order to encourage the flow, recourse should be had to the use of the warm hip-bath; indeed, very frequently it will be found that a hot hip-bath, containing a handful of the flowers of mustard, used every night for the week preceding the regular time for the flow to appear, and accompanied by a good rubbing with a rough towel of the hips and lower part of the front of the body, will greatly assist in bringing on the flow.

5713. Treatment for Interrupted or Suppressed Menstruation. The same suggestions in the way of treatment apply as in No. 5712. When interruption has taken place suddenly, recourse should be had to the warm hip-bath, bed, and some warm drink, such as sherry and water, or a little brandy, or hot ginger water. When cessation for one or more periods has occurred, then it is specially important to favor, as much as possible, its restoration by attention to those particulars of general treatment already adverted to.

5714. Treatment of Excessive Menstruation. Those who are liable to this form of irregular menstruation should be careful in their diet, choosing a plain and nutritious one. They should attend to the function of the bowels, and maintain a horizontal posture from the time when the discharge commences till its cessation. In addition, if the discharge, besides being copious, is continuous, recurring over and over again, it is necessary to have recourse to powerful remedies. When the discharge is so profuse as rapidly to reduce the patient's strength, still more, if by it, as has happened sometimes, life be brought into peril, local means of arresting bleeding must also be adopted; foremost among these is the application of cold—cold cloths placed over the lower part of the body, and to the groins. Injections of cold water may further be employed if the nurse or relatives are skilled in the use of the injecting instrument, but not otherwise.

5715. Difficult or Painful Menstruation. The most common form of this complaint is ranged under the head of neuralgia, for the violent pain with which it is accompanied bears a close resemblance to neuralgic pains experienced in other parts of the body. In such, if the affection is of long standing, the nervous system generally has probably sympathized, and headache, with hysteria and many other distressing symptoms, accompany the menstrual disorder. Many cases of this nature are connected with marked constitutional derangement, more particularly with gout and rheumatism. For the relief to the extreme pain which accompanies the complaint, soothing remedies are rendered indispensable, and the most suitable medical ones will be prescribed by the medical attendant. In his absence, or conjoined to the medicines, the warm hip-bath may be tried, followed by the application of mustard poultices, or flannel wrung out of hot water and sprinkled with turpentine, over the lower part of the back. In the general treatment, the greatest attention must be paid to diet and regimen.

5716. Remedy for Suppressed Menstruation. Make into 12 pills, 12 grains sulphate of iron, 6 grains powdered aloes, and 12 grains white turpentine. Dose, 1 at bedtime. (*See No.* 5441.)

5717. Ashwell's Injection for Obstructed Menstruation. Mix 1 to 2 fluid drachms liquor of ammonia with 1 pint of milk; use thrice daily, commencing with the least quantity of ammonia.

5718. Injection for Obstructed Menstruation. Take 1 fluid drachm liquor of ammonia, 1 ounce mucilage, and 9 fluid ounces water; use in the same way as the last receipt.

5719. Pills for Suppressed Menstruation. Take dried sulphate of iron, 1 scruple; powdered aloes, 2 scruples; powdered cloves, 5 grains; Venice turpentine, sufficient to make a mass, and divide into 20 pills. One pill 3 times a day.

5720. To Relieve Vomiting During Pregnancy. Mix 2 ounces sweet tincture of rhubarb, and 1 ounce compound tincture of gentian. Dose, a tea-spoonful 3 times a day.

5721. To Cure Vomiting in Pregnancy. Mix 1 drachm carbonate of magnesia, ½ ounce tincture of colombo, 5½ ounces peppermint water. Take a table-spoonful 3 times a day.

5722. Citric Acid in After-pains. Dr. J. B. Chagnon recommends citric acid for the pains following labor, and declares that it has never failed in his hands. He gives 5 grains in 2 or 3 ounces of water every 5 hours. It acts as a nervine, and as a preventive of inflammation.

5723. Pills to Remove Obstructions in Females. Aloes and lobelia, 1 drachm each; black cohosh, gum myrrh, tansy, unicorn root, 1 ounce each; cayenne, ½ ounce. Mix, and form into pills with solution of gum. These pills remove female obstructions, and are good for headaches, lowness of spirits, nervousness, and sallowness of the skin.

5724. Female Regulating Pills. Aloes, red oxide of iron, white turpentine, 1 ounce each. Melt the turpentine, and strain; mix well; form into pills with mucilage. Take 2 or 3 per day.

5725. Alum Injection for Leucorrhœa. Compound solution of alum, 6 drachms; water, 1 quart. Mix, and use it lukewarm.

5726. Lead Injection for Leucorrhœa. Sugar of lead, 60 grains; water, 1 quart. Mix.

5727. Catechu Injection for Leucorrhœa. Catechu, 1 drachm; myrrh, 1 drachm; lime-water, 12 ounces. Mix, and dilute with water.

5728. Caustic Injection for Leucorrhœa. Nitrate of silver, 35 grains; water, 1 quart. Mix.

5729. Zinc Injection for Leucorrhœa. Sulphate of zinc, 40 grains; water, 1 quart. Mix.

5730. To Cure Sore Nipples. This painful affection of the breast, especially so during the period of nursing, may be cured as follows: Arrest the bleeding by a slight application of compound tincture of benzoin, carefully dry the parts with a soft muslin handkerchief; apply a solution of gutta-percha, so as to completely surround the nipple and cover all abrasions, giving it three or four coatings, allowing each to dry thoroughly before repeating the application. During the act of suction, a boxwood shield, with calf's teat, should be used, and in the course of a few days all will be well. The solution of gutta-percha is prepared by dissolving 1 drachm gutta percha in a bottle containing 3 drachms chloroform. The film rapidly formed by the evaporation of the chloroform is firm, elastic, and harmless, and, should it rub off, is very easily replaced. The almost painless nature of the treatment, the effectual protection from the contact of the air and irritation of the infant's mouth recommend it strongly to general use.

5731. Harland's Gonorrhœa Cure. Mix together 1½ ounces powdered cubebs; ½ ounce balsam copaiba; ½ ounce powdered gum-arabic; and 3 ounces cinnamon water. A table-spoonful of the mixture to be taken at intervals 8 times a day.

5732. Harland's Gonorrhœa Injection. Mix 2 scruples Armenian bole, and 10 grains sulphate of zinc, with 4 ounces water. Inject 3 or 4 times a day.

5733. Goddard's Gonorrhœa Mixture. Take 2 drachms oil of cubebs; ½ ounce balsam of copaiba; 1 ounce each syrup of tolu and syrup of poppy; 2 drachms *strong* liquor of potassa; 1 drachm oil of juniper; and 2½ ounces peppermint water. A table-spoonful 3 times a day.

5734. Goddard's Gonorrhœa Injection. Mix 3 drachms solution of iodide of iron with 4 ounces spring water. Apply with a syringe 3 times a day.

5735. Spackman's Copaiba Mixture. Mix together 2 drachms syrup of gum-arabic; ½ ounce balsam of copaiba; 24 drops oil of cubebs; 1 ounce syrup of balsam of tolu; ½ ounce each sweet spirits of nitre and compound tincture of opium; 20 drops tincture of opium; 3 drops oil of lavender, and 3 drachms compound spirits of lavender. Dose, a table-spoonful 3 times a day.

5736. Permanganate of Potassa in Gonorrhœa. Dr. John G. Rich has employed this remedy with great success. He begins the treatment with a purgative, and then uses as an injection, 3 times a day, 6 grains of permanganate of potassa dissolved in 1 ounce water.

5737. To Apply Caustic to the Urethra. A weak solution of nitrate of silver (2 or 3 grains in 1 ounce rose-water), may be used as an injection twice a day. Some prefer a stronger solution of 10 grains to the ounce, injected every 2 or 3 days. It may be also administered as an ointment of 10 to 20 grains to the ounce, smeared on a bougie and introduced into the urethra. This is perhaps better for severer cases of gonorrhœa; the injections answering the purpose for milder cases, and gleet.

5738. Ricord's Gonorrhœa Injection. Mix 15 grains each sulphate of zinc and acetate of lead, with 6½ ounces rose-water. Inject 3 times a day.

5739. Cure for Nocturnal Emissions. Mix 50 grains bromide of potassa with 25 grains each aromatic powder and white sugar. Make up into 12 powders, 1 to be taken 2 or 3 times a day.

5740. Remedy for Difficulty in Urinating. Mix together 1 scruple each oil of turpentine, extract of henbane, and soap. Make it into 12 pills, and administer 1 pill 3 times a day.

5741. To Relieve Spasm of the Bladder. To relieve the spasm, place the patient in a hot bath immediately, and keep him there, supplying fresh hot water when required, until he is relieved, or he becomes at all faint or fatigued. Then put him into a bed which has previously been well warmed, and keep hot cloths, hot salt, hot bran, or hot tins applied, to prevent a return of the pain if possible; and as the medical treatment is of great consequence, lose no time in summoning the medical man.

5742. Remedy for Disease of the Kidneys. Boil 1 ounce pareira brava in 3 pints of water until it is only 1 pint. Dose, a wine-glassful 3 times a day.

5743. Remedy for Incontinence of Urine. Put 4 drops tincture of aconite root in a tumbler of water. Dose, a tea-spoonful every hour until relieved.

5744. Remedy for Nocturnal Incontinence of Urine. Nocturnal incontinence of urine has been treated successfully by administering from 15 to 20 minims of tincture of belladonna 3 times daily.

5745. Remedy for Incontinence of Urine of Old People. The continued use of 1 to 6 drops tincture of iodine daily has proved a successful remedy.

5746. Remedy for Spermatorrhœa. Gelseminum, ½ grain; lupulin, 3 grains. To be taken each night on retiring. Gradually diminish the dose as the patient shows signs of improvement.

5747. Belladonna as a Remedy for Typhoid Fever. Dr. B. Kelly, of Dublin, has met with great success in the use of belladonna in typhoid fever. Within 24 hours after the first dose, he found delirium, &c., vanish, succeeded by calm, natural sleep, clearness of intellect, and complete repose of the system, accompanied by regular evacuations. Dr. Lewis S. Pilcher, of the U. S. Navy, reports equally successful results from the use of this drug. The amount and frequency of the dose will probably be understood by every physician, as the authorities above quoted do not specify these points.

5748. Remedy for Festering Wounds and Cancers. Professor Boettger recommends gun cotton, saturated with a solution of permanganate of potassa, put up in the form of a poultice, and held over an open wound by a bandage, as the best disinfectant for bad odors that can be conveniently applied. The strength of the solution of permanganate, best adapted for the purpose, is 1 part, by weight, of the dry permanganate, in 100 parts water. Ordinary cotton cannot be taken, as it readily decomposes, but gun cotton is permanent, and not liable to explosion when in a moist state.

5749. Treatment for Measles. In the treatment of the ordinary cases of measles occurring in children otherwise than delicate, little is necessary beyond attention to the temperature of the room, the amount of the bed-clothes, preventing the access of too strong a light, which affects the eyes, &c. Great care should be taken that draughts of cold air are avoided, lest they might prove the cause of increase in the chest complaint, which generally attends the attack; and, while the room is not overheated, it must not, for the same reason, be allowed to be cool. It must be remembered that in measles, as in all fevers accompanied by an eruption, the patient will require a more abundant supply of blankets, &c., before the eruption appears, than after it. Indeed, afterwards, he generally desires light clothing. The room should be well ventilated; all excrements and dirty linen immediately removed. Disinfectants should be used. The sense of heat and dryness of the body, sometimes most distressing to the patient, can be much alleviated by washing the surface with soap and tepid water; too great exposure being avoided by one part of the body being cleansed, dried, and covered, before the rest is exposed. The feeling of tension of the hands and feet can be relieved by rubbing these parts with some greasy matter, such as lard or simple salve. All sources of annoyance or irritation, all noises, should be avoided, and thus sleep is promoted, a condition which most materially affects the welfare of the patient, sleep lessening the fever and increasing the appetite. Food, light and nutritious, such as arrowroot, gruel, good beef-tea, milk, chicken, or veal broth, plain wine, jellies, &c., should be given at the usual hours. The quantity should be moderate, great care being taken that the digestion be not impaired by too large a quantity being taken. Should the patient be very weak, the food must be administered in small quantities at frequently repeated intervals. There is no stimulant so important as food. The prospect of recovery in all fevers is very greatly if not mainly dependent on the power of digesting and assimilating food possessed by the patient. The bowels should be moved by a mild laxative, such as the lenitive electuary (*see No.* 5154), effervescing magnesia, or castor oil; and, so as to produce a little perspiration, a small dose (for a child, a tea-spoonful), of mindererus spirit (*see No.* 5143), in a little water, may be given at intervals of 2 or 3 hours. If the rash is long in appearing, or shows a disposition to disappear, the development of the eruption may be secured by placing the child in a warm bath; if the child appears sunk and the pulse be feeble, a little warm wine and water may be administered. In ordinary cases, the early appearance of the eruption will be favored by administering a dose of sulphur (a small tea-spoonful for a child, in milk); and if there be much hoarseness, and croupy character of the breathing and cough, it will be expedient to apply a hot sponge over the throat. (*See No.* 5626.) With the appearance of the eruption, these symptoms usually decline. Measles not unfrequently terminate in an attack of bowel complaint; this may be slight, and if so, will not require any medicinal treatment; indeed, it is salutary, but, on the other hand, when severe, and occurring in a delicate child, prompt means for arresting it must be adopted (such as are mentioned under the head of Diarrhea. (*See No.* 5652, *&c.*) If there be often-repeated sickness, food of the very blandest nature, pounded raw meat (the fat and gristle being removed before pounding), beef-tea, uncooked white of egg diluted with water, barley water, &c., should be given in small quantities, and be very frequently repeated. Thirst, and the consequent restlessness, must be allayed by drinks. Large draughts should be prohibited, as they tend to impair the digestion, and sometimes cause diarrhea; small quantities, swallowed slowly, or ice to suck, are sufficient to allay thirst, and also prove grateful to the patient. The patient, however, must be allowed to take larger quantities of fluids than in health, as an increased quantity is required by the system during the existence of fever. Acid, or acid and bitter drinks are generally found to lessen thirst to a greater degree than mere water, and are, moreover, grateful to the patent. Lemonade with very little sugar, or raspberry vinegar and water, will be found useful. Stimulants are administered to support the strength of the patient. This they do in a great measure by promoting digestion, and by also directly increasing the force of the heart's action. The administration and quantity of stimulants given cannot be regulated by the condition of the patient. Medical advice is particularly necessary here. Various complications are apt to take place, so that, if possible, advice should be had early in the day. If no advice is at hand, the symptoms must be treated according to the directions given under the particular heads.

5750. Scarlet Fever. The preliminary treatment for this disease is very similar to that for measles. Give the patient a gentle cathartic, and keep very warm in bed until the eruption appears. (*See No.* 5749.) The after-treatment consists of administering a gargle every 15 minutes, when the patient is awake. Make a gargle of 2 table-spoonfuls each brewer's yeast and strained honey, mixed with 1 pint strong sage tea, and alternate it with the potassa gargle. (*See No.* 5064.) Keep the skin of the patient moist by washing all over, at least 3 times a day, with a solution of saleratus and water as hot as it can be borne; after each washing grease the patient all over thoroughly, with a piece of fat bacon. Great care must be taken to prevent the patient from catching cold in every stage of the disease, and the same cautions about ventilation, warmth, diet, &c., given under the head of measles, must also be observed in the treatment of scarlet fever. The patient must not be exposed to any great or sudden changes of temperature, even 3 weeks after convalescence, as a relapse might be the consequence.

5751. Preliminary Treatment of Scarlatina and Measles. The preliminary treatment is simple: from ½ grain calomel, for children, to 5 grains for adults, should be placed on the tongue and swallowed. About an hour after, the first dose of the ammonia (*see next receipt*) is to be given, and repeated every 3 or 4 hours, as long as the disorder takes a favorable course. If the disorder increases in violence, the medicine must be given every 2 hours, or every hour, or sometimes even more frequently, till the graver symptoms are subdued. This medicine has been found to possess similar powers over diphtheria.

5752. Treatment of Scarlatina and Measles. Dr. Witt states that sesquicarbonate of ammonia is an antidote to scarlatina and measles. The dose in these complaints varies from 3 to 10 grains, according to the age of the patient, given at longer or shorter intervals, according to the mildness or severity of the attack. The suitable dose dissolved in as small a quantity of cold water as will admit of its being swallowed with as many grains of loaf sugar, merely to make it palatable, is all that is required. Any admixture with other medicines, as salines, bark, &c., and all acidulous drinks, are to be avoided.

5753. Preventive of Scarlet Fever. Belladonna has been found to render persons unsusceptible to the fever, in places where it is raging. It is to be given in extract, $\frac{1}{20}$ grain morning and evening.

5754. Remedy for Dropsy in Scarlatina. Mix together 1½ drachms acetate of potassa; 6 grains extract of foxglove; 2 drachms vinegar of squill; 6 drachms syrup of ginger; and 2 ounces water. Dose, 1 tea-spoonful every 3 hours.

5755. Atlee's Scarlet Fever Remedy. ½ ounce each chlorate of potassa and hydrochloric acid, and ½ ounce spring water. Dose, 10 drops in a wine-glassful of cold water every 2 hours.

5756. Intermittent Fever Pills. Take 10 to 12 grains white oxide of arsenic; 1 drachm muriate of ammonia, and 12 grains gum opium. Make into 64 pills. Dose, 1 to be taken morning, noon and night, with or without fever.

5757. Intermittent Fever Mixture. Take 5 grains tannin, 16 grains sulphate of quinine, 1 ounce syrup of ginger, and ½ ounce cinnamon water. Take 1 tea-spoonful every hour, in the absence of the fever.

5758. Treatment of Small-Pox. Advice should always be obtained as soon as the earliest symptoms appear; often the only symptom understood by the parents or friends is the eruption. In the absence of advice, the simpler cases of small-pox, unattended by much eruption, scarcely require any further treatment than confinement of the patient to bed, adminstering at the commencement a dose of aperient medicine, such as effervescing magnesia (*see No.* 4805, *&c.*,) or castor oil, &c., and, until the eruption appears, of a few doses of mindererus spirit (*see No.* 5143), to promote perspiration. In the more severe cases there are individual symptoms of an unfavorable nature not unlikely to be developed, and these must be met by appropriate treatment. The imperfect filling of the pustules is generally accompanied by a low form of fever, requiring the use of stimulants, wine or brandy; these must, of course, be administered with great caution. In all stages, if the patient present a sunken look, and the pulse be feeble, the necessity for stimulants is indicated. By giving them with caution is meant that only just sufficient to keep up the vital powers should be given.

5759. To Prevent Pitting in Small-Pox. The following has been found very effectual: The application consists of a solution of india-rubber in chloroform, which is painted with a camel-hair pencil over the surface of the skin, where exposed, when the eruption has become fully developed. When the chloroform has evaporated, which it very readily does, there is left a thin elastic film of india-rubber over the face. This the patient feels to be rather comfortable, as it removes itching and all irritation; and, what is more important, pitting, once so common, is thoroughly prevented by the application. In making the solution, the india-rubber must be cut into small pieces, and chloroform added till it is dissolved. Gutta-percha has been tried, but has not answered, on account of its non-elasticity. Should any of the solution, from some cause, be torn off, apply the solution as before.

5760. Dr. George's Treatment to Prevent Pitting in Small-Pox. Dr. George recommends the following treatment: Firstly, from the commencement of the disease cover the whole body, face and all, with calamine, shaken through a common pepper-box, taking care that the powder does not remain in masses. The inflammation on each pustule is by these applications much lessened, a point of great consequence. Secondly, sprinkle about 1 ounce powdered camphor every 2 or 3 nights between the under sheet and blanket, the whole length of the body, putting more about the shoulders and neck. The relief obtained by this, few would credit until they had had experience. Thirdly, in the advanced stage of the disease, should hardened incrustations have formed, they may be removed, and without much pain too; for in one case every portion of the cuticle was removed from the whole face, forehead, and even eyelids, the calamine applied, and in a few days the cuticle was formed again without a blemish.

5761. Calamine. Native carbonate of zinc. It is prepared and purified for medicinal purposes by heating to redness, and pulverizing it, afterwards reducing it to an impalpable powder in the same manner as directed for prepared chalk. (*See No.* 1292.)

5762. To Remove Pitting and Old Pock-Marks. To remove pitting and old pock-marks, simple oil, pomade, or ointment, medicated with croton-oil, and of a strength just sufficient to raise a very slight pustular eruption, is probably the safest and most effective and convenient of all the preparations that are employed for the purpose. It has for some years been successfully employed in France and has there received medical approval. Dr. Cooley says he has seen it succeed to admiration, when every other method has failed. It should be applied at intervals extending over several weeks, as the feelings, experience, and convenience of the party concerned may indicate, due care and caution being observed the whole time.

5763. Treatment of an Attack of Apoplexy. Loosen the clothes, especially those about the neck and throat, and send *at once* for a physician. Meanwhile, remove the patient into a cool, well-ventilated room, raise the head above the level of the body, and apply cold to the head, either by means of rags dipped in water, never allowing them to become warm, or by ice in a bladder, &c. The diet will require great care when the patient is reviving. Only very small quantities of milk, beef-tea, &c., must be given until he is able to digest more. Supposing the patient to recover from the fit, great care will be afterwards required to prevent a second attack. Strong medicines, great excitement, or much mental occupation are to be avoided. The diet ought to be light, but nutritious; milk is useful, taken to the extent of 1½ or 2 pints in the day; and, as a rule, no spirits or wine should be allowed.

5764. Remedy for Shortness of Breath. Take spirits of ether, 1 ounce, and camphor, 12 grains. Make a solution, of which take a tea-spoonful during the paroxysm. This is usually found to afford instantaneous relief in difficult breathing, depending on internal disease and other causes, where the patient, from a quick and very laborious breathing, is obliged to be in an erect posture.

5765. To Relieve Shortness of Breath. Take ½ ounce powder of elecampane root, ½ ounce powder of liquorice, as much flower of brimstone and powder of aniseed, and 2 ounces sugar-candy powdered. Make all into pills, with a sufficient quantity of tar; take 4 large pills when going to rest. This is an incomparable medicine for asthma.

5766. Palpitation of the Heart. Soda water, either the usual carbonated water, or prepared from effervescing soda powders, frequently gives instant relief in an attack of palpitation of the heart.

5767. To Relieve Palpitation of the Heart. Take 40 drops tincture of digitalis (fox-glove); 20 drops tincture of aconite; 2 drachms tincture of henbane; 6 drachms camphor-water. Dose, a tea-spoonful 3 times a day.

5768. Biliousness. Persons subject to bilious attacks should be particularly careful to guard against excess in eating and drinking, and should especially avoid those articles of food which, from experience, they find to disagree with them. A mutton chop undercooked is an excellent article for the breakfast or lunch of a bilious patient; and mutton or beef, either broiled or roasted, so that the gravy be retained, is better for dinner than many articles apparently more delicate. Beer and porter should be particularly avoided, as well as puddings and most articles of pastry, as they are very indigestible. Hard cheese, butter, unripe fruit, and especially beans, peas, and nuts, are also objectionable. An attack of bile may frequently be prevented by the use of a saline purgative, and it may generally be removed by a blue pill, followed with a mild purgative.

5769. To Remove Tumors. To remove tumors, Dr. Simpson, of Edinburgh, introduces a hollow acupuncture needle, or very fine *trocar* (a surgical instrument in the form of a fine hollow needle) into their tissue, and injects a few drops of some irritant liquid, such as a solution of chloride of zinc, perchloride of iron, or creosote. The effect has been to destroy the vitality of the tumors so treated, and they have been separated. A similar plan has been adopted in Paris by M. Maisonneuve. He had slender stylets made of a paste composed of flour, water, and chloride of zinc. These are baked. A puncture is made in the tumor, the caustic stylet is inserted, broken off, and left. Several malignant tumors have been successfully treated in this manner, and in some cases a healthy granulating surface was left, after the separation of tumors which had been destroyed in this manner.

5770. Treatment of Rupture. Rupture is generally caused by a strain or an accident, and should be attended to by a surgeon as soon as possible. Meanwhile the patient must be laid upon a sofa or bed with his hips and legs slightly raised, so as to give him ease and to place the rupture in the most favorable position for being restored to its proper place. If the patient is faint, support him by giving wine and water, or sal-volatile, or a little broth, but do not over-stimulate him. In other respects he must be kept perfectly quiet.

5771. To Relieve Lockjaw. Let any one who has an attack of lockjaw take a small quantity of spirits of turpentine, warm it, and pour it on the wound, no matter where the wound is, or what its nature is, and relief will follow in less than 1 minute. Nothing better can be applied to a severe cut or bruise than cold turpentine; it will give certain relief almost instantly.

5772. Cure for Cancer. The use of clover tea is said to effect speedy and effectual cures of cancer, even in its most malignant form, and of long standing. The red clover is used; the tops are boiled in water, and the tea is used externally and internally. About a quart a day should be administered internally, and the tea should be used as a wash twice every day.

5773. Remedy for Scrofula. Put 1 ounce aqua-fortis in a bowl or saucer; drop in it 2 copper cents; when the effervescence ceases, add 2 ounces strong vinegar. The fluid will be of a dark green color. It should and will smart. If too severe, dilute it with a little rain-water. Apply it to the sore, morning and evening, by a soft brush or a rag. Before applying it, wash the sore with water. This receipt comes well recommended for curing old sores and other scrofulous eruptions.

5774. Anti-Scrofulous Mixture. Mix 30 drops tincture of bichloride of gold; 40 drops tincture of iodine; 1 fluid drachm tincture of gentian; 7 fluid drachms simple syrup, and 5 fluid ounces rose-water. Dose, a dessert-spoonful 3 or 4 times daily, in a wine-glassful of water, observing to shake well before pouring out the liquid.

5775. White Swelling. This is a very painful disease; it more frequently affects the knee than any other joint; sometimes the hip, ankle, and elbow. At first a severe pain is felt penetrating the joint, or only one particular part of the joint. The least motion aggravates the pain. It soon begins to swell considerably, and suppuration takes place. Matter is discharged from several openings or ulcers, the bones are affected; and if the disease is not arrested the life of the patient is endangered.

5776. Treatment of White Swelling. Attend to the stomach and bowels, giving an emetic and an aperient, if needed; to be followed by bitter tonics occasionally, giving the alterative syrup (*see No.* 5163), diluted when first taken; or a decoction of sarsaparilla, sassafras, guaiacum, queen's delight, unicorn root, cleavers, and prickly ash berries, of each 1 ounce. Simmer in a covered pan with 2 quarts water down to 3 pints. Sweeten. A dessert-spoonful 3 or 4 times a day. Steam the part with bitter herbs, and now and then give a vapor bath to the whole body. After steaming the affected part, rub the limb with the rheumatic liquid. (*See No.* 4884.)

5777. Beach's Cure for White Swelling. Oil of hemlock, oil of sassafras, gum camphor, tincture of opium, ½ ounce each, and a pint of spirits of wine. When dissolved and properly mixed, bathe the part with it frequently. Then apply an oatmeal and bran poultice, mixed with a little finely powdered charcoal, salt, and cayenne pepper. If the pain is great, sprinkle on the poultice ¼ ounce laudanum. Keep it on as long as possible, and then steam.

5778. To Relieve Sea-Sickness. Take camphorated spirit, sal-volatile, and Hoffman's anodyne, a few drops of each, mixed in a small quantity of water, or upon a small lump of sugar. This often relieves when other prescriptions fail.

5779. To Prevent Sea-Sickness. The neutralizing mixture (*see No.* 5666) is a good preventive. So is a tea-spoonful of bicarbonate of soda in ½ pint of water. Take an aperient before a voyage. One of the best means of counteracting the tendency to sea-sickness, is to keep a horizontal position. A little chloroform has lately been suggested as a good remedy. 5 to 10 drops on a piece of lump sugar.

5780. Treatment of Debility. This arises from a diseased action of the stomach; the occasional use of mild aperients, followed by bitters and tonics, is the best treatment. When, from a general laxity of the solids, and there are no symptoms of fever, nor a tendency of the blood to the head, a course of iron tonics will prove advantageous. Either of the following may be adopted for this purpose: Pure sulphate of iron, 1 drachm; extract of gentian and powdered ginger, of each 1½ drachms; beat together into a mass, and divide into 120 pills, 1 to be taken morning, noon, and night. Or: Sulphate of iron and powdered myrrh, of each 1 drachm; sulphate of quinine, ½ drachm; conserve of roses, sufficient to form a pill mass. Divide into 120 pills, administered as the last.

5781. Remedy for Sick Stomach and Vomiting. Mix 24 drops creosote, 1 drachm each white sugar and gum-arabic, with 3 ounces water. Administer a tea-spoonful every 2 hours, until vomiting ceases.

5782. Sunstroke. This is a sudden prostration due to long exposure to great heat, especially when much fatigued or exhausted. It commonly happens from undue exposure to the sun's rays in summer, but the same effects have been produced in a baker from great heat of the bake-room. It begins with pain in the head, or dizziness, quickly followed by loss of consciousness and complete prostration. Sometimes, however, the attack is as sudden as a stroke of apoplexy. The head is often burning hot, the face dark and swollen, the breathing labored and snoring, and the extremities cold.

5783. Treatment of Sunstroke. Take the patient at once to a cool and shady place, but don't carry him far to a house or hospital. Loosen the clothes thoroughly about his neck and waist. Lay him down with the head a little raised. Apply wet cloths to the head, and mustard or turpentine to the calves of the legs and the soles of the feet. Give a little weak whiskey and water if he can swallow. Meanwhile let some one go for the doctor.

You cannot safely do more without his advice.

5784. Precautions Against Nightmare. Avoid all exciting causes, as too much abstruse thinking, late and heavy suppers, food difficult of digestion, cold feet, costiveness, and flatulence.

5785. To Prevent the Nightmare. To prevent the nightmare, mix together 10 grains carbonate of soda; 3 drachms compound tincture of cardamoms; 1 drachm simple syrup, and 1 ounce peppermint water. Repeat for several nights in succession; afterwards use for a few weeks the tonic aromatic mixture. (*See No.* 5124.) Also a little cayenne in scullcap tea will prevent an attack. Those who are habitually subject to nightmare should not sleep in a room alone, but have some person near them, to arouse them when attacked with it. A person is most liable to nightmare when sleeping on his back; in fact, it rarely occurs in any other posture. Those subject to it should therefore avoid sleeping in a bed which is hollow in the centre, as this induces the sleeper to lay on his back. The bed should be level and not too soft, and the pillow moderate in thickness, so that the head is not raised too high.

5786. To Restrain Perspiration. Spring water, 2 ounces; diluted sulphuric acid, 40 drops; compound spirits of lavender, 2 drachms; take a table-spoonful twice a day.

5787. Remedy for Night Sweats of Consumption. M. Guyot recommends as particularly useful, in the sweats of consumption, the phosphate of lime in quantities of from ½ to 1½ drachms in the day. In a small proportion of cases it may be inert; but in the majority it will diminish or quite remove the trouble.

5788. Treatment for Night-Sweats in Consumption. Powdered borax, 5½ drachms; washed sulphur, 1 ounce; subnitrate of bismuth, 1½ drachms; divide into 40 powders, 1 to be given every 2 hours (12 a day). 4 to 5 days of treatment will suspend or diminish this troublesome and exhausting symptom, and give much relief to the patient.

5789. To Relieve Night-Sweats. Dissolve 15 grains sulphate of quinine in ½ ounce essence of tansy, ½ ounce alcohol, ½ ounce water, and 30 drops muriatic acid. A teaspoonful taken 2 or 3 times during the day and at bed-time. In connection with this remedy, cold sage tea is recommended to be used freely as a drink.

5790. Squinting. It is well known that in infancy there is not unfrequently a tendency to squint; this often passes away as the child increases in age; but it sometimes becomes quite a fixed habit, requiring a surgical operation for its permanent cure. A means of rendering this operation unnecessary by curing the tendency in early life has been suggested, which is worthy of trial. A pair of spectacles is procured without any glasses in them. One of the orifices opposite the eye that squints is to be filled with thin horn or with ground glass, and in the centre of the horn or glass is to be made a small hole. It is obvious that to see with the squinting eye it is necessary for the child to look directly through the orifice in the centre. He will thus acquire the habit of looking forward towards an object, instead of looking to the right or left hand of it. It is not at all improbable that the slight squint, which in infancy is apparently only a habit, may be remedied by this means.

5791. Treatment of Styes. A stye is a small boil which projects from the eyelid, much inflamed, and very painful. The application of ice to the part will sometimes check it in the beginning. Apply a poultice of linseed meal, or bread and milk, and take at the same time an aperient. If the stye is ripe, puncture it, and then apply spermaceti ointment.

5792. To Treat a Black Eye. This is usually caused by a blow. If attended with inflammation and pain, wash the eye often with very warm water, in which is dissolved a little carbonate of soda; or with equal parts of tincture of opium and water. If the pain be acute, foment with a decotion of stramonium leaves, simmered in spirits. Wash the eye, and bind on the leaves; often repeat. Perhaps the best application is a poultice of slippery elm bark. Mix with milk and put it on warm.

5793. To Cure a Black Eye. To remove the discoloration of the eye, bind on a poultice made of the root of Solomon's seal. Culpepper says it is available for bruises, falls, or blows, to dispel the congealed blood, and to take away the pains, and the black and blue marks that remain after the hurt. The root may be washed, the dark-colored skin carefully cut off, then scraped like horse-radish, and applied direct to the eye in the way of a poultice, cold. A tingling sensation is the consequence; when this sensation ceases, another fresh application should be made, and repeated until the whole discoloration is absorbed. It is often found sufficient to apply the scraped root at bed-time to the closed eye, when the blackness has disappeared by the morning. Or: Moisten with tepid water, and then with a piece of lint apply pure extract of lead; continue to keep the lint wet with the extract for a couple of hours. Leeches ought not to be used. A lotion often used by surgeons with advantage is prepared thus: Take nitrate of potassa and sal-ammonia, each 1 part; water, 48 parts; vinegar, 4 parts. The part bruised to be kept wet with this by means of a bandage.

5794. To Remove Dirt or Foreign Particles from the Eye. Take a hog's bristle, double so as to form a loop. Lift the eyelid and gently insert the loop up over the ball, which will occasion no disagreeable feeling. Now close the lid down upon the bristle, which may now be withdrawn. The dirt will surely be upon the bristle. M. Renard, in the case of small movable bodies which become entangled beneath the upper eyelid, recommends the following simple process: Take hold of the upper eyelid near its angles, with the forefinger and thumb of each hand, draw it gently forwards and as low down as possible over the lower eyelid, and retain it in this position for about a minute, taking care to prevent the tears from flowing out. When, at the end of this time, you allow the eyelid to resume its place, a flood of tears washes out the foreign body, which will be found adhering to, or near to, the lower eyelid. If lime gets into the eyes, a few drops of vinegar and water will dissolve and remove it. Almond or olive oil will do away with any hot fluid that may reach the eye.

5795. **To Expel Insects, Dirt, &c., from the Eye.** The first thing to be done when a mote or spark gets into your eye, is to pull down the lower part of the eyelid, and with a handkerchief in your hand blow your nose violently at the same moment. This will frequently expel the mote without further trouble. A mote will, in many cases, come out of itself, by immediately holding your eye wide open in a cup or glass filled to the brim with clear cold water.

5796. **To Extract Particles of Iron or Steel from the Eye.** A particle of iron or steel may be extracted from the eye by holding near it a powerful magnet.

5797. **Eye-Waters.** Eye-waters should be perfectly clear, and free from any floating matter, however trifling. To secure this, it is in general necessary either to filter them through bibulous paper, or a piece of clean, fine muslin, or to carefully decant them after sufficient repose to allow the impurities to subside. When pure distilled water is used in their preparation, only some of them will require filtering. In using eye-waters, a little of the liquid should be poured into a clean cup, gallipot, or glass, or into the clean palm of the left hand, when the eye should be thoroughly wetted with it, either by means of a small piece of clean sponge or soft white rag, or the clean tips of the fingers of the right hand. In all cases it is advisable to bathe or wash the eyes in tepid water, and to wipe them dry, before the application of the eye-water; and, in most cases, this is absolutely necessary to insure benefit from their use. In the preparation of eye-waters, substances of crystalline formation are better when used dry, that is, deprived of their water of crystallization. (*See No.* 2065.)

5798. **Astringent Eye-water.** Take of sulphate of zinc, 20 grains; distilled water, ½ pint; dissolve. An excellent astringent eye-water, in chronic as well as ordinary ophthalmia, as soon as the inflammatory symptoms subside; also in weak, lax, watery, irritable eyes, &c. If there be much pain and irritability, 5 or 6 grains of acetate of morphia, or 2 fluid drachms of wine of opium, may be added.

5799. **Eye-water for Weak Eyes.** Take ½ ounce rock salt and 1 ounce of *dry* sulphate of zinc; simmer in a perfectly clean covered porcelain vessel with 3 pints of water until all are dissolved; strain through thick muslin, add 1 ounce of rose-water; bottle and cork it tight. To use it, mix 1 tea-spoonful of rain-water, with 1 of eye-water, and bathe the eyes, if weak, frequently. If it smarts too much, add more water; if not enough, make it a little stronger by adding more eye-water. This is an admirable wash for weak eyes. It cannot be excelled.

5800. **Wash for Inflamed Eyes.** Take 10 drops extract of lead (the liquor of acetate of lead); distilled vinegar, 2 drachms; distilled water, 4 ounces. This is an excellent wash for inflamed eyes.

5801. **Anodyne Eye-water.** Solution of acetate of ammonia, 2 ounces; distilled water, hot, 6 ounces; soft extract of opium, 10 grains. Dissolve the opium in the hot water, strain through fine muslin, and add the solution of the acetate of ammonia. This application frequently affords great relief from the pain and irritation accompanying inflammation.

5802. **Eye-water for Specks on the Eye.** Oxymuriate of mercury, ½ grain; best rose-water, 4 ounces. This solution is of much use in removing the indolent inflammation and the white specks which an acute inflammation of the eyes frequently leaves after it.

5803. **Bates' Eye-water.** Dissolve in 4 fluid ounces boiling water, 15 grains *dry* sulphate of copper (*see No.* 5797), and 4 grains camphor. When cold, add water to make it 4 pints, and filter. Good in purulent ophthalmia.

5804. **Goulard's Eye-water.** Solution diacetate of lead, 10 drops; rose or elder-flower water, 6 fluid ounces. Mix. Good in inflammatory stage of ophthalmia.

5805. **Wash for Removing Particles of Iron or Zinc from the Eye.** Muriatic acid, 20 drops; mucilage, 1 drachm; mix with 2 fluid ounces rose-water.

5806. **To Allay Temporary Irritation or Weakness in the Eye.** Temporary inflammation, produced by cold or external causes, is rapidly allayed by frequently bathing the eye with lukewarm milk and water, or rose-water; applied either with a linen rag or by means of an eye-glass. A poultice of tea-leaves (the wet leaves left in the tea-pot) is also an excellent remedy. Probably the best remedy of all is to put a table-spoonful of salt in a basin of water (say ½ gallon), immerse the face in this twice a day, opening the eyes under the water, and using fresh salt and water every day. The eyes should under no circumstance be rubbed, as that will increase the irritation.

5807. **Atropine Paper.** Green tissue paper imbued with a solution of sulphate of atropia, so that a piece one-fifth of an inch square contains as much as a drop of a solution 2 grains to 1 ounce of water. The paper is hung up and turned about while drying. A piece of the size named will dilate the pupil if placed on the sclerotic, and the lids closed over it and tied with a handkerchief.

5808. **Belladonna Mixture for Cataract.** Triturate together 1 drachm each extract of belladonna and glycerine. Used for dilating the pupil of the eye in cataract, by anointing the eyebrow and temple.

5809. **Taylor's Remedy for Deafness.** Digest 2 ounces bruised garlic in 1 pound oil of almonds for a week, and strain. A drop poured into the ear is effective in temporary deafness.

5810. **Treatment of Earache.** M. Emile Duval says that he has, in person, found relief in severe earache, after other means had been tried in vain, from the use of a mixture of equal parts of chloroform and laudanum; a little being introduced on a piece of cotton. The first effect produced is a sensation of cold; then there is numbness, followed by scarcely perceptible pain and refreshing sleep

5811. Cure for the Earache. Take a small piece of cotton batting or cotton wool, make a depression in the centre with the finger, and fill it up with as much ground pepper as will rest on a five-cent piece; gather it into a ball and tie it up; dip the ball into sweet oil and insert it in the ear, covering the latter with cotton wool, and use a bandage or cap to retain it in its place. Almost instant relief will be experienced, and the application is so gentle that an infant will not be injured by it, but experience relief, as well as adults. 1 part laudanum and 6 parts sweet oil dropped in the ear is also very effectual.

5812. Simple Cure for Earache. Take a common tobacco-pipe, place a wad of cotton in the bowl, drop upon it 8 or 10 drops of chloroform, and cover with another wad of cotton; place the stem to the affected ear, then blow into the bowl, and in many cases the pain will cease almost immediately.

5813. Remedy for Inflammation of the Ear. Swelling and redness, attended with throbbing, indicates it. If caused by accumulation of wax, syringe the ear forcibly with tepid water. If by cold, a poultice of warm hops, soaking the feet. If the pain is great, 1 drop laudanum and 2 drops sweet oil of almonds dropped into the ear 3 times a day, or juice of onions and laudanum. A slice of onion, toasted and tied on hot outside the ear, is a good remedy for earache in children, and often effective with adults. If very severe, a mustard poultice can be held behind the ear. If the stomach is out of order use an emetic. If no relief comes, call a physician.

5814. Remedy for Temporary Deafness. If deaf from hardened wax in the ear, a mixture of sassafras oil, 10 drops; glycerine, 1 fluid drachm; olive oil, ½ fluid ounce, mixed, may be dropped into the ear every day. If deaf from other causes, go to the physician.

5815. Cure for Temporary Deafness. Inject warm water into the ear by means of a proper syringe, the head being placed with that side upwards during the operation.

5816. To Destroy Insects in the Ear. Insects may be destroyed by pouring a spoonful of warm olive oil, or camphorated oil, into the ear over night, retaining it there until the next morning by means of a piece of cotton wool, when it may be washed out with a little mild soap and warm water.

5817. To Cure Habitual Drunkenness. The following singular means of curing habitual drunkenness is employed by Dr. Schreiber, a Russian physician: It consists in confining the drunkard in a room, and in furnishing him at discretion with his favorite spirit diluted with ⅔ of water; as much wine, beer, and coffee as he desires, but containing ⅓ of spirit; all the food—the bread, meat, and the vegetables steeped in spirit and water. The poor patient is continually drunk. On the fifth day of this treatment he has an extreme disgust for spirit; he earnestly requests other diet; but his desire must not be yielded to, until he no longer desires to eat or drink; he is then certainly cured of his love of drink. He acquires such a disgust for brandy, or other spirits, that he is ready to vomit at the very sight of it.

5818. Tonic After Drinking to Excess. Mix together 5 grains sulphate of quinine; 10 drops aromatic sulphuric acid; ½ ounce compound tincture of gentian; 2 drachms compound tincture of cardamoms; 1½ ounces ginger syrup; and 2 ounces water. A table-spoonful administered 3 times a day will remove the prostrating effects of drinking to excess.

5819. Remedy for Chafing. Stout persons suffer greatly, especially in warm weather, from chafing. We know of nothing better than a wash of alum dissolved in water, and applied with a linen or cotton rag.

5820. Lotion for Bed-Sores. To 1 table-spoonful of powdered alum put 1 teacupful of whiskey and bathe the sore part several times a day.

5821. To Relieve Irritation in Bed-Sores. Apply to the sores the white of an egg, well beaten, and mixed with spirits of wine.

5822. To Prevent and Cure Chapped Hands. Wash the hands with fine soap; and before removing the soap, scrub the hands with a table-spoonful of Indian meal, rinsing thoroughly with soft tepid water, using a little meal each time except the last; wipe the hands perfectly dry; then rinse them in a very little water containing a tea-spoonful of pure glycerine, rubbing the hands together until the water has evaporated. This is an excellent remedy, but the glycerine must be pure, or it will irritate instead of healing.

5823. Treatment of the Nails. The nails should be kept clean by the daily use of the nail-brush and soap and water. After wiping the hands, but while they are still soft from the action of the water, gently push back the skin which is apt to grow over the nails, which will not only keep them neatly rounded, but will prevent the skin cracking around their roots (hang-nails), and becoming sore. The points of the nails should be pared at least once a week; biting them should be avoided.

5824. To Remove Warts. A daily application of either of the three following remedies is effective in dispersing warts: Touch the wart with a little nitrate of silver (lunar caustic); or with nitric acid or aromatic vinegar. The lunar caustic produces a black, and the nitric acid a yellow stain, which passes off in a short time; the vinegar scarcely discolors the skin. Sparks of frictional electricity, repeated daily, by applying the warts to the conductor of an electrical machine, have been also successfully employed as a cure for these troublesome and unsightly excrescences.

5825. Wart or Corn Powder. Ivy-leaves dried and ground to fine powder. A popular and useful remedy for warts and soft corns. The part having been moistened with strong vinegar, a pinch of the powder is sprinkled on it, and then bound on with a strip of rag. This is sometimes called *cosmetic vegetable caustic.* A mixture of equal parts of savine and verdigris also make an efficacious wart powder.

5826. To Remove Moles. Croton oil, under the form of pomade or ointment, and potassio-tartrate of antimony (tartar emetic), under the form of paste or plaster, have each recently been successfully employed for the removal of ordinary moles and birth-marks.

The following is the mode of using the latter adopted by an eminent French surgeon: Take tartar emetic in impalpable powder, 15 grains; soap plaster, 1 drachm; and beat them to a paste. Apply this paste to nearly a line in thickness (not more), and cover the whole with strips of gummed paper. In 4 or 5 days eruption or suppuration will set in, and, in a few days after, leave, in place of the birthmark, only a very slight scar. Croton oil ointment effects the same, but less completely unless repeated, by producing a pustular eruption, which, however, does not permanently mark the skin. (*See No.* 5762.)

5827. Ingrowing Toe Nails. This most painful of the diseases of the nails is caused by the improper manner of cutting the nail (generally of the great toe), and then wearing a short, badly-made shoe. The nail beginning to grow too long, and rather wide at the corners, is trimmed around the corner, which gives temporary relief. But it then begins to grow wider in the side where it was cut off; and, as the shoe presses the flesh against the corner, the nail cuts more and more into the raw flesh, which becomes excessively tender and irritable. If this state continue long the toe becomes more and more painful and ulcerated, and proud-flesh sprouts up from the sorest points. Walking greatly increases the suffering, till positive rest becomes indispensable.

5828. Treatment of Ingrowing Toe Nails. Begin the effort at cure by simple application to the tender part of a small quantity of perchloride of iron. It is found in drug stores in a fluid form, though sometimes in powder. There is immediately a moderate sensation of pain, constriction or burning. In a few minutes the tender surface is felt to be dried up, tanned or mummified, and it ceases to be painful. The patient, who before could not put his foot to the floor, now finds that he can walk upon it without pain. By permitting the hardened, wood-like flesh to remain for 2 or 3 weeks, it can be easily removed by soaking the foot in warm water. A new and healthy structure is found firm and solid, below. If thereafter the nails be no more cut around the corners or sides, but always curved in across the front end, they will in future grow only forwards; and by wearing a shoe of reasonably good size and shape, all further trouble will be avoided.

5829. To Prevent the Nail Growing into the Toe. If the nail of your toe be hard, and apt to grow round, and into the corners of your toe, take a piece of broken glass and scrape the top very thin; do this whenever you cut your nails, and, by constant use, it makes the corners fly up and grow flat, so that it is impossible they should give you any pain. Do not fail to try this.

5830. Remedy for Blistered Feet from Long Walking. Rub the feet, at going to bed, with spirits, mixed with tallow dropped from a lighted candle into the palm of the hand.

5831. Method of Preventing Cold Feet at Bed-time. Draw off your stockings just before undressing, and rub your ankles and feet well with your hand, as hard as you can bear the pressure, for 5 or 10 minutes, and you will never have to complain of cold feet in bed. It is hardly conceivable what a pleasurable glow this diffuses. Frequent washing of the feet, and rubbing them thoroughly dry with a linen cloth or flannel, is very useful.

5832. Chilblain. This is an inflammatory swelling, of a purple or lead color, produced by the action of cold. Children, especially those of a scrofulous habit, and elderly persons, are generally most liable to chilblains. The common cause is holding the hands or feet to the fire, after exposure to cold. The sudden change of temperature partially destroys the vitality, and prevents the proper flow of blood through the part. As chilblain is only another name for a languid circulation in the part affected, indicated by a congested skin, or a low form of inflammation, the value of most of the following receipts will be apparent when it is noticed that they are all calculated to act as stimulants of the blood-vessels, and thus promote the motion of the partially stagnant blood which gives rise to the heat and itching that are so distressing. (*See No.* 5006.)

5833. Remedy for Broken Chilblains. Mix together 4 fluid ounces collodion, 1½ fluid ounces Venice turpentine, and 1 fluid ounce castor oil.

5834. Zinc Wash for Chilblains. Dissolve 1 ounce sulphate of zinc in 1 pint water. Apply several times a day.

5835. Chilblain Lotion. Dissolve 1 ounce muriate of ammonia in ½ pint cider vinegar, and apply frequently. ½ pint alcohol may be added to this lotion with good effects.

5836. Petroleum Liniment for Chilblains. Nothing appears of such uniform utility for allaying the inflammatory irritation, as the ordinary petroleum or kerosene oil.

5837. To Cure Chilblains. M. W. E. Schaller says that the fluid concentrated chloride of iron is an unfailing remedy for chilblains, its application to them for a single day effecting a cure. It may also be used with advantage for frost-bites.

5838. Remedy for Severe Chilblains. From 10 to 60 grains nitrate of silver dissolved in 1 fluid ounce water has been sometimes found useful after other applications had appeared of no benefit. Tincture of cantharides, to stimulate almost to blistering, has also been used in the more intractable forms of the disease. The tincture of capsicum has been presented as a specific in this disease.

5839. Chilblain Balm. Boil together 10 fluid ounces olive oil, 2 fluid ounces Venice turpentine, and 1 ounce yellow wax; strain, and while still warm add, constantly stirring, 2½ drachms balsam of Peru, and 9 grains camphor.

Another formula for making this balm adds ½ ounce alkanet root, but employs ½ drachm less of the balsam of Peru. This is applied by being spread on a soft cloth and laid on the part affected.

5840. Chilblain Liniment. Mix together 1 fluid ounce rectified oil of turpentine, 15 drops sulphuric acid, and 2 ounces olive oil. This, rubbed gently on the chilblains twice a day, is generally very effective.

5841. **To Cure Chilblains.** The following remedy was published by order of the Wirtemberg government. Mutton tallow and lard, of each ¾ pound avoirdupois; melt in an iron vessel and add hydrated oxide of iron, 2 ounces; stirring continually with an iron spoon, until the mass is of a uniform black color; then let it cool, and add Venice turpentine, 2 ounces; and Armenian bole, 1 ounce; oil of bergamot, 1 drachm; rub up the bole with a little olive oil before putting it in. Apply several times daily by putting it upon lint or linen. It heals the worst cases in a few days.

5842. **Russian Remedy for Chilblains.** Slices of the rind of fully-ripe cucumbers, dried with the soft parts attached. Previous to use they are softened by soaking them in warm water, and are then bound on the sore parts with the inner side next them, and left on all night. This treatment is said to be adopted for both broken and unbroken chilblains.

5843. **Remedy for Itching Feet from Frost-bites.** Take hydrochloric acid, 1 ounce; rain water, 7 ounces; wash the feet with it 2 or 3 times daily, or wet the socks with the preparation until relieved.

5844. **To Cure Slight Frost-bites.** The remedy for this is long-continued friction with the hands or cold flannel, avoiding the fire or even a heated apartment.

5845. **To Correct an Offensive Smell in the Feet.** Bathe them in a weak solution of permanganate of potassa; 1 scruple of the salt to 8 ounces of water. (*See No.* 1701.)

5846. **Powder for Absorbing Excessive Perspiration of the Feet.** Mix together 7 ounces carbonate of magnesia, 2 ounces powdered calcined alum, 7 ounces orris root, and ½ drachm powdered cloves.

5847. **Corns.** Corns are entirely owing to continued pressure, such as wearing small boots or shoes. At first they are the production of the outer skin only, but by gradually thickening they at length come to be connected with the true skin beneath, and even with the subjacent muscles. (*See Nos.* 5079 *and* 5060.)

5848. **To Prevent Corns.** Prevention is better than cure. Wear woolen stockings, and see that there is no local and permanent pressure on any part of the foot.

5849. **To Cure Corns.** If a cure be requisite, soak the corn for ½ hour in a solution of soda, and pare as close as possible; then apply a plaster of the following ingredients: Take of purified ammonia and yellow wax, of each 2 ounces; and acetate of copper, 6 drachms. Melt the first two ingredients together, and, after removing them from the fire, add the acetate of copper just before they grow cold. Spread this ointment on a piece of soft leather or on linen, and apply it to the corn, removing it in two weeks.

5850. **To Cure Soft Corns.** The soft corn occurs between the toes, and is produced in the same manner as the common corn; but in consequence of the moisture existing in this situation, the thickened scarf-skin becomes saturated, and remains permanently soft. The soft corn is best relieved by cutting away the thick skin with a pair of scissors, avoiding to wound the flesh; then touching it with a drop of Friar's balsam, and wearing habitually a piece of cotton wool between the toes, changing the cotton daily. Tincture of arnica, applied on a piece of cotton wool, is also said to be an excellent remedy.

5851. **To Cure Soft Corns.** Dip a piece of linen rag in turpentine and wrap round the toe on which the corn is situated, night and morning. The relief will be almost immediate, and in a few days the corn will disappear.

5852. **To Relieve Hard Corns.** Bind them up at night with arnica, to relieve the pain. During the day, occasionally moisten the stocking over the corn with arnica, if the shoe is not large enough to allow the corn being bound up with a piece of linen rag.

5853. **Remedy for Corns.** Soak the feet well in warm water, then with a sharp instrument pare off as much of the corn as can be done without pain, and bind up the part affected, with a piece of linen or muslin thoroughly saturated with sperm oil, or, what is better, the oil which floats upon the surface of the pickle of herring or mackerel. After 3 or 4 days the dressing may be removed, and the remaining dead cuticle removed by scraping, when the new skin will be found of a soft and healthy texture and less liable to the formation of a new corn than before.

5854. **To Relieve Corns.** Take a lemon, cut off a small piece, then nick it so as to let in the toe with the corn, tie this on at night, so that it cannot move, and in the morning you will find that, with a blunt knife, you may remove a considerable portion of the corn. Make two or three applications, and great relief will be the result.

5855. **Remedy for Corns.** The pain occasioned by corns may be greatly alleviated by the following preparation: Into a 1-ounce phial put 2 drachms of muriatic acid and 6 drachms of rose-water. With this mixture wet the corns night and morning for 3 days. Soak the feet every evening in warm water without soap. Put one-third of the acid into the water, and, with a little picking, the corn will be dissolved.

5856. **Liquid Solvent for Corns; Corn Solvent.** A saturated solution of salt of tartar or pearlash. It is commonly obtained by exposing the article, contained in a jar or wide-mouthed bottle, in a damp place, until it forms an oil-like liquid.

5857. **To Cure Bunions.** A bunion is a swelling on the ball of the great toe, and is the result of pressure and irritation by friction. The treatment for corns applies also to bunions; but, in consequence of the greater extension of the disease, the cure is more tedious. When a bunion is forming it may be stopped by poulticing and carefully opening it with a lancet.

5858. **To Cure a Corn on the Sole of the Foot.** A corn on the sole of the foot is usually difficult to cure, as the weight of the body causes a constant pressure on it. The application of an ordinary corn-plaster, with a hole in the centre, will relieve the pressure from the corn, but it causes an inequality under the foot, which is not only uncomfortable, but likely to produce other corns. The following method never fails: Cut a piece of stout cardboard (or thin binders' board) to fit inside the sole of the boot. This should be large enough in every way to prevent it shifting under the foot in walking. Next cut a round hole in this inner sole, exactly where the corn rests, the hole being rather larger than the corn. This arrangement relieves the corn from pressure and allows of its rapid cure, at the same time affording instant relief and freedom in walking.

5859. To Cure a Disagreeable Breath. This most disagreeable infliction may be alleviated or cured by one or other of the following remedies, provided that the teeth do not require a dentist's assistance. Chlorine water, as supplied by a good chemist, a table-spoonful to half a tumbler of water, to be used as a wash and gargle for the mouth; no harm will be done if a few drops are accidentally swallowed in so doing. Charcoal in tea-spoonful doses of the powder, or as charcoal biscuits, or the use of prepared chalk as a tooth-powder. A frequent cause of foul breath is a torpidity of some of the excretory organs, such as the skin, kidneys, bowels, liver, lungs. When these cease performing their functions one of the others will be called upon to perform an extra office. In this way, when the bowels or skin become affected, the lungs, being an excretory organ, will be called upon to throw off an additional waste from the system. If so, the breath becomes tainted. Should the foul breath be depending upon the stomach, it must be corrected by some skillful physician.

5860. Remedy for Bad Breath. Take of dry hypochlorite of lime, 3 drachms; distilled water, 2 ounces troy. Triturate the hypochlorite of lime in a glass pestle and mortar; when the hypochlorite has been thoroughly pulverized add a portion of the distilled water; allow the mixture to rest until the liquid has become transparent; then decant; add a second portion of water, triturate and allow to rest, again decant; this process is repeated a third time. The three liquids which have been decanted are then mixed, and 2 troy ounces of 85 per cent. alcohol, and 4 drops oil of roses or some other essential oil are added. The solution thus prepared may be employed to remove the fetid odor which is given off by the gums—an odor often due to the diseased condition of the tissues. To employ it, ½ tea-spoonful is poured into a tumblerful of water, and the gums are washed with the mixture, employing for the purpose a sponge-brush. The same preparation may be employed to remove the odor of tobacco, rinsing the mouth several times with water to which has been added a tea-spoonful of the liquid. Inasmuch as the odor of the essential oil is gradually diminished in time, said diminution taking place at the expense of the chlorine of the hypochlorite, it is suggested that this inconvenience may be obviated by preparing the solution with water and the hypochlorite of lime, and keeping it in one bottle, while the aromatic alcoholic solution (prepared of 2 ounces of 85 per cent. alcohol and 4 drops of essential oil) is preserved in another, both being well stoppered. When it is desired to use the liquids, a half tea-spoonful of each of the solutions is poured into a glass of water, which is then employed as described above.

5861. Remedy for Bad Breath. Take 5 to 10 drops hydrochloric acid in half a tumbler of spring water, a little lemon juice, and loaf sugar rubbed on lemon peel to flavor it to suit the palate. Let this mixture be taken 3 times a day for a month or six weeks, and, if useful, then continued occasionally. It is a pleasant refrigerant and tonic draught.

5862. Remedy for Bad Breath. Bad or foul breath will be removed by taking a tea-spoonful of the following mixture after each meal: 1 ounce liquor of potassa, 1 ounce chloride of soda, 1½ ounces phosphate of soda, and 3 ounces water.

5863. Bad Breath from Constipation. When the breath is affected by constipation of the bowels, the following mixture will be useful: Take 4 drachms Epsom salts, 8 drachms tincture of columba, 6 ounces infusion of roses; well shake the phial each time you take the draught, which should be every other morning for a month or six weeks, a wine-glassful each time.

5864. To Remove the Smell of Onions from the Breath. Parsley eaten with vinegar will remove the unpleasant effects of eating onions.

5865. To Correct the Odor of Decayed Teeth. To correct the odor of decayed teeth, 2 drops of a concentrated solution of permanganate of potash may be used in a glass of water as a wash, or a few drops of a weak solution may be introduced in the cavity of the tooth on a small piece of cotton. (*See No.* 1701.)

5866. To Preserve the Teeth and Gums. The teeth should be washed night and morning, a moderately small and soft brush being used; after the morning ablution pour on a second tooth-brush, slightly damped, a little of the following lotion: carbolic acid, 20 drops; spirit of wine, 2 drachms; distilled water, 6 ounces. After using this lotion for a short time the gums become firmer and less tender, and impurity of the breath (which is most commonly caused by bad teeth) will be removed. It is a great mistake to use hard tooth-brushes, or to brush the teeth until the gums bleed. (*See Nos.* 1288, *&c.*

5867. Magnetic Pain-Killer for Acute Pain and Toothache. This is one of the very best receipts for relieving acute pain and toothache. Laudanum, 1 drachm; gum camphor, 4 drachms; oil of cloves, ½ drachm; oil of lavender, 1 drachm; add these to 1 ounce alcohol, 6 drachms sulphuric ether, and 5 fluid drachms chloroform. Apply with lint; or, for toothache, rub on the gums, and upon the face against the tooth.

5868. Blake's Cure for the Toothache. Take alum, reduced to an impalpable powder, 2 drachms; spirits of nitric ether, 7 drachms. Mix, and apply them to the tooth. This is said to be an infallible cure for all kinds of toothache unless the disease is connected with rheumatism.

5869. Chloral for Toothache. Dr. Page recommends chloral hydrate as a local application in cases of toothache. A few grains of the solid hydrate introduced into the cavity of the tooth upon the point of a quill speedily dissolves there; and in the course of a few minutes, during which a not unpleasant warm sensation is experienced, the pain is either deadened, or, more often, effectually allayed. A second or third application may be resorted to if necessary. (*Brit. Med. Journ.*)

5870. To Cure Toothache. To 1 drachm flexible collodion add 2 drachms carbolic acid. A gelatinous mass is precipitated, a small portion of which inserted into the cavity of an aching tooth invariably gives immediate relief.

5871. Chlorate of Potassa as a Cure for Toothache. According to the experience of eminent dentists, chlorate of potassa affords quick relief in toothache. If the hollow tooth is in the lower jaw, a small crystal of this salt may be put in the cavity; but perhaps it is more advisable to use a solution of 1 part of the potassa in 20 of water.

5872. Paste for Toothache. Take of root-bark of pellitory, 1 drachm; muriate of morphia, 5 grains; triturate until reduced to fine powder, then add, finest honey, 3 drachms; oil of cloves (or of cajeput), 20 drops; concentrated tincture of pellitory, a sufficient quantity to form the whole into a smooth paste. Very effective.

5873. Cure for Toothache. Take equal parts of burnt alum and salt. Saturate a piece of cotton, cover with the mixture, and put in the tooth. Or saturate a small bit of clean cotton wool with a strong solution of ammonia, and apply it immediately to the affected tooth. Immediate relief will be experienced.

5874. Perry's Essence for the Toothache. A concentrated tincture of pellitory made with about equal parts of ether and rectified spirit largely charged with camphor. Though a nostrum, it is an excellent preparation. (*See No.* 4532.)

5875. Pieste's Toothache Essence. This is laudanum mixed with about twice its volume of liquor of ammonia specific gravity .960. Applied on lint, like other toothache drops, it often rapidly relieves the pain.

5876. Cottereau's Odontalgic Essence. A nearly saturated ethereal solution of camphor, mixed with $\frac{1}{10}$ to $\frac{1}{12}$ its volume of liquor of ammonia (specific gravity .880 to 882). A very useful preparation.

5877. To Kill the Nerve of a Hollow Tooth. Take $\frac{1}{2}$ drachm white oxide of arsenic; 1 drachm sulphate of morphia; mix with a little creosote, and apply to the cavity of the tooth, previously cleansed.

5878. Tooth Cements. These are preparations for filling up cavities, cracks, &c., in defective teeth, the object being either to restore or preserve them, or to cure or prevent toothache. (*See Nos.* 3549, &c.)

5879. Diamond Tooth Cement. Take of anhydrous phosphoric acid in fine powder, 12 grains; pure caustic lime, fresh burnt, and in fine powder, 13 grains; mix them rapidly, by trituration, in a porcelain or wedgwood-ware mortar, and apply the powder, in the dry state, as quickly as possible, as it soon becomes moist. The powder, after being well pressed in the crack or cavity of the tooth, is smoothed off with the finger moistened with a drop of water. It soon acquires great hardness, is white, very durable, and does not become discolored by age. The compound that results from the combination of the ingredients almost exactly resembles the natural earthy matter of the teeth, and is, therefore, unobjectionable. Its color closely resembles, and will soon become that of the teeth to which it is applied, provided they possess ordinary whiteness. To cause it at once to imitate the color of the teeth, the mixture may be rendered slightly grey by adding to it a mere trace of carbon. This may be done by holding the pestle, used to mix the powders, over the flame of a candle or lamp, for an instant. A faint yellowish shade may be given to it by a trace of sulphuret of cadmium or a little yellow ochre; and a faint shade of red or flesh-color by a trace of jeweler's rouge or peroxide of iron, or a very little light-red (burnt yellow-ochre). This stopping, from its composition and other qualities, is, perhaps, superior to all others; but, except in the case of hollow teeth, its use requires some degree of skill and expertness, which is, however, readily acquired.

5880. Gutta-Percha Stopping for Teeth. This is pure, uncolored, native gutta-percha. A small piece is softened in hot water, and at once applied. It answers well for filling hollow teeth with central cavities, and is efficient and durable.

5881. White Gutta-Percha. The Journal of Applied Chemistry gives the following method of preparing this, for dentists' use and for other purposes. 4 ounces of pure gutta-percha are digested with 5 pounds of methyl-chloroform until the solution is thin enough to pass through filtering paper. It is then filtered (an additional pound of chloroform will facilitate this), and should then be clear and nearly colorless. Alcohol is now added in sufficient quantity to precipitate the gutta-percha in a voluminous white mass, which is washed with alcohol, pressed in a cloth, and dried in the air. It must finally be boiled in water in a porcelain vessel for half an hour, and, while still hot, rolled into sticks. The chloroform can be separated from the alcohol by adding water, and the alcohol recovered by distillation. (*See No.* 1725.)

5882. How to Fill or Plug Teeth. One of the most important points to attend to in filling or stopping teeth, is that each tooth must be thoroughly cleaned out, and wiped perfectly dry, before inserting or applying the cement, of whatever kind it be. Without careful attention to this matter, the cement will not adhere, or will soon become loose, and drop out or off, and the operation prove a failure. When a defective tooth is conveniently situated it may often be stopped by the party himself, by the exercise of a little skill and care, particularly if it be a hollow one with a clearly defined central cavity. When the reverse is the case, it is generally necessary that the operator should be a second party. A hollow tooth with a central and nearly circular hole in it may, in general, be effectively filled with a plug of dry soft wood, or of bone or ivory. If the hole be not round, it may be made so. Such stopping will often last for years.

5883. To Remove Tattoo Marks from the Skin. Inquiry is frequently made for methods for the successful removal of tattoo marks in the skin. While these are generally asserted to be indelible, if produced by the insertion of some carbonaceous matter, a correspondent of the Chemical News says that the marks disappeared by being first well rubbed with a salve of pure acetic acid and lard, then with a solution of potash, and finally with hydrochloric acid.

5884. To Remove Freckles. If the exact cause of freckles were known, a remedy for them might be found. A chemist in Moravia, observing the bleaching effect of mercurial preparations, inferred that the growth of a local parasitical fungus was the cause of the discoloration of the skin, which extended and ripened its spores in the warmer season. Knowing that sulpho-carbolate of zinc is a deadly enemy to all parasitic vegetation (itself not being otherwise injurious), he applied this salt for the purpose of removing the freckles. The compound consists of 2 parts of sulpho-carbolate of zinc, 25 parts of distilled glycerine, 25 parts of rose-water, and 5 parts of scented alcohol, and is to be applied twice daily for from half an hour to an hour, then washed off with cold water. Protection against the sun by veiling and other means is recommended, and in addition, for persons of pale complexion, some mild preparation of iron.

5885. To Remove Liver-spots. These are well-defined, brownish blotches on the skin, and generally appear on the forehead. Notwithstanding their name, they do not always proceed from the liver alone, but usually from some derangement or unhealthy state of the internal organs. In the first place, the general health must be thoroughly cared for, in order to have a fair prospect of success in any external local application. A pomade composed of 20 grains of sulphate of zinc and 1 ounce elder-flower ointment should be applied over-night to the spot, entirely within its limits, and not on the surrounding skin. In the morning wash it off with white castile soap and water, and bathe it repeatedly during the day with a lotion composed of 30 grains citric acid and ½ pint infusion of roses. The spots should yield to this treatment in about 2 weeks, and their recurrence may be prevented by a regular use of borax and glycerine lotion. (*See No.* 4839.)

5886. To Remove Birth-marks. Mix together, with frequent agitation, 1 part pure carbonate of potash, 4 parts rose-water, 2 parts Hoffmann's Life Balsam (*see No.* 5112), and 2 parts distilled water. Apply to the mark twice a day, shaking the bottle well before using. (*Hager.*) (*See No.* 5826.)

5887. To Disguise the Taste of Medicines. Instead of attempting to flavor the medicine, or to remove the disagreeable taste from the mouth *after* taking the medicine, it is far more efficacious to prepare the mouth beforehand with some strong aromatic flavor, such as orange or lemon peel, or cachou aromatise. (*See No.* 1336.) In preparing the mouth for bitters, liquorice is the only *sweet* that should be used, all others creating a peculiarly disagreeable compound taste.

5888. To Disguise the Taste of Castor Oil. Castor or cod-liver oil may be taken with porter by pouring a little in the bottom of the glass, and then a little on top of the oil, but the best method of covering the nauseous flavor is to put a table-spoonful of strained orange-juice in a wine-glass, pour the castor oil into the centre of the juice, and then squeeze a few drops of lemon-juice upon the top of the oil, and rub some of the juice on the edge of the glass.

5889. French Method of Administering Castor Oil to Children. Pour the oil into a pan over a moderate fire; break an egg into it, and stir up; when it is done, add a little salt or sugar, or some currant jelly. The sick child will eat it agreeably, and never discover the disguise.

5890. To Destroy the Taste of Castor Oil. A good way is to beat the castor oil with the white of an egg until both are thoroughly mixed.

5891. To Disguise the Taste of Epsom Salts. Peppermint water almost prevents the nauseous taste of Epsom salts; a strong solution of extract of liquorice covers the disagreeable taste of *aloes;* milk, that of Peruvian bark; and cloves, that of senna.

5892. Agreeable Mode of Taking Senna. Dr. Linthner says that senna leaves (1 or 2 drachms to 1 or 2 cups of water) should be allowed to infuse all night in cold water. With the strained infusion coffee is prepared next morning, as if with water; and an aperient which does not taste of senna, and does not cause griping, is thus produced.

5893. Restoration of Persons Apparently Dead from Drowning. The following rules for the restoration of persons apparently dead from drowning, are given by Professor Benjamin Howard, of this city, and sanctioned by the Metropolitan Board of Health of the City of New York.

I. Unless in danger of freezing, never move the patient from the spot where first rescued, nor allow bystanders to screen off the fresh air, but instantly wipe clean the mouth and nostrils, rip and remove all clothing to a little below the waist, rapidly rub and dry the exposed part, and give two quick, smarting slaps on the stomach with your open hand. If this does not succeed immediately, proceed according to the following rules to perform artificial breathing:

II. Turn the patient on his face, a large bundle of tightly rolled clothing being placed beneath his stomach, and press heavily over it upon the spine for half a minute.

III. Turn the patient quickly again on his back; the roll of clothing being so placed beneath it as to make the short ribs bulge prominently forward, and raise them a little higher than the level of the mouth. Let some bystander hold the tip of the tongue out of one corner of the mouth with a dry handkerchief, and hold both hands of the patient together, the arms being stretched forcibly back above the head.

IV. Kneel astride the patient's hips, and with your hands resting on his stomach, spread out your fingers so that you can grasp the waist about the short ribs. Now throw all your weight steadily forward upon your hands, while you at the same time squeeze the ribs deeply, as if you wished to force everything in the chest upwards out of the mouth. Continue this while you can slowly count—one—two—three; then suddenly let go, with a final push, which springs you back to your first kneeling position. Remain erect upon your knees while you can count—one—two; then throw your weight forward again as before, repeating the entire motions—at first about 4 or 5 times a minute, increasing the rate gradually to about 15 times a minute, and continuing with the same regularity of time and motion as is observed in the natural breathing which you are imitating.

V. Continue this treatment, though apparently unsuccessful, for 2 hours, until the patient begins to breathe; and for a while after this, help him by well-timed pressure to deepen his *first* gasps into full, deep breaths; while the friction of the limbs, which should, if possible, have been kept up during the entire process, is now further increased.

VI. As soon as the breathing has become perfectly natural, strip the patient rapidly and completely. Wrap him in blankets only. Put him in bed in a room comfortably warm, but with a free circulation of fresh air, and, except for the administration of internal treatment, let him have perfect rest. Give him a little hot brandy and water, or other stimulant at hand, every 10 or 15 minutes for the first hour, and as often thereafter as may seem expedient.

5894. Abstinence as a Cure for Disease. Disease may often be cured by abstinence from all food, especially if the disorders have been produced by luxurious living and repletion. The latter overtaxes nature, and it rebels against such treatment. Indigestion, giddiness, headache, mental depression, &c., are often the effects of greediness in meat and drink. Omitting one, two, or three meals, allows the system to rest, to regain strength, and allows the clogged organs to dispose of their burdens. The practice of drug-taking to cleanse the stomach, though it may give the needed relief, always weakens the system, while abstinence often secures the same result, and yet does no injury.

5895. Antidotes for Poison. It need hardly be said that medical assistance must be sent for at once; but, meanwhile, as it is of the greatest importance to administer some aid as soon as possible, the subjoined directions may be followed. When any poisonous or other hurtful thing has been swallowed, take instantly half a glass of water—cold, not hot—put into it a heaping tea-spoonful of salt, and another of ground mustard; stir it rapidly 3 or 4 times; if there is no salt at hand, use mustard alone; catch the patient by the nose and toss it down. The reason for using cold water is that, in the hurry, the water may be hotter than thought for, and may scald the throat, causing eventual, if not instant death. The salt and mustard make the speediest emetic known, and are almost everywhere to be had in a moment. It brings up the contents of the stomach more or less completely. And for fear that some remnant may be left, administer a cupful of strong coffee, and then the white of 2 or 3 raw eggs, either first, as may be the quickest had, because these are two domestic articles which are found in every house, and nullify the effects of a greater number of virulent poisons than perhaps any other articles known. (*Hall.*)

5896. Treatment in Cases of Poisoning. Dr. Hall says: Whatever is done must be done quickly. The instant a person is known to have swallowed poison by design or accident, give water to drink, cold or warm, as fast as possible, a gallon or more at a time, and, as fast as vomited, drink more; tepid water is best, as it opens the pores of the skin and promotes vomiting, and thus gives the speediest cure to the poisonous article. If pains begin to be felt in the bowels, it shows that part at least of the poison has passed downwards; then large and repeated injections of tepid water should be given, the object in both cases being to dilute the poison as quickly and as largely as possible. Do not wait for warm water—take that which is nearest at hand, cold or warm, for every second of time saved is of immense importance; at the same time send instantly for a physician, and as soon as he comes turn the case into his hands, telling him what you have done. This simple fact cannot be too widely published; it is not meant to say that drinking a gallon or two of simple water will cure every case of poisoning; but it will cure many, and benefits all by its rapidly diluting quality. (*Journal of Health.*) A short summary of the antidotes resorted to in reference to particular poisons is given below. They should, of course, be administered as speedily as possible.

5897. Antidotes for Acid Poisons. Hydrochloric acid; nitric acid; oxalic acid (often mistaken for Epsom salts); *acetic* acid. For this form of poison, give quickly large draughts of chalk, whiting, magnesia, or soap and water, about as thick as cream; followed by albuminous diluents, such as milk, and white of egg mixed with water. Or, if these cannot be procured at once, warm water; and promote vomiting by the emetic recommended in No. 5895.

5898. Antidotes for Arsenic. The first endeavor, in cases of poisoning by arsenic, should be to remove, if possible, the poison from the stomach; for this purpose strong emetics or the stomach-pump should be had recourse to, after which the hydrated peroxide of iron in a dose thirty times greater than that of the poison may be administered. (*See No.* 4155.)

5899. Antidotes for Baryta in all its Forms. Sulphate of magnesia (Epsom salts), sulphate of soda (Glauber's salts), or any alkaline or earthy sulphate.

5900. Antidotes for Antimony, or Tartar Emetic. Administer large doses of warm water to induce vomiting (*see No.* 5896); give the powder of Peruvian bark, and, as soon as it can be prepared, the infusion of bark, which decomposes the tartar emetic.

5901. Antidotes for Alkalies, Soda, Potash, Ammonia, &c. Vinegar and lemon-juice are the best antidotes for potash, and all other alkaline poisons. A glassful of water, mixed with a table-spoonful of vinegar or lemon-juice, should be given frequently; and in defect of these, simple water, in such quantities as to cause vomiting. Emetics, and other irritating means, are to be avoided. Olive oil may also be administered.

5902. Antidotes for Corrosive Sublimate, or Calomel. The white of eggs beaten up with cold water is the best antidote for these. If eggs are not at once to be had, milk may be used with great success. Warm water should be given afterwards, to induce vomiting, also free purging in most instances.

5903. Antidote for Corrosive Sublimate. In case of poisoning by corrosive sublimate, if a dose of the hydrated protosulphuret of iron (*see No.* 4149) be administered it instantly renders the poison innocuous. This antidote is almost useless unless taken within 15 or 20 minutes after swallowing the poison.

5904. Antidotes for Verdigris and Sulphate of Copper. The treatment is the same as for corrosive sublimate. (*See No.* 5902.)

5905. Antidotes for Nitrate of Silver. Same as for corrosive sublimate (*see No.* 5902), with copious draughts of warm water and salt. (*See No.* 5895.)

5906. Antidote for Phosphorus. Same as for corrosive sublimate. (*See No.* 5902.) Phosphorus is the principal ingredient used in the manufacture of matches.

5907. Antidote for Sulphate of Zinc. Solution of carbonate of soda; also cream, butter, and chalk, are good antidotes for sulphate of zinc (white vitriol). Give water after the antidotes.

5908. Antidotes for Lead. *Litharge, red lead, white lead, sugar of lead, and Goulard's extract.* In the first stage, or the irritant form of injury, administer sulphate of magnesia, potash, or soda. The phosphate of soda is a good antidote. When palsy supervenes, the regimen must be regulated carefully.

5909. Antidotes for Opium and its Preparations. Emetics of the sulphate of zinc, ½ drachm or 2 scruples; the stomach pump, or injections of tartar emetic, must be employed to bring away the poison. The patient should be constantly roused by dragging about the floor, throwing cold water in the face, and giving ammonia, assafœtida, and strong coffee.

5910. New Antidote for Opium. In a case of accidental poisoning by an overdose of morphia, the administration of 18 drops of Norwood's tincture of green hellebore was followed by a complete cure. The narcotic had obtained such mastery over the unfortunate patient that the pupils of the eyes had contracted, and the jaws had to be forced open to give the medicine, which was mixed with 2 ounces of brandy. All appearance of poisonous effects had vanished in an hour.

5911. Antidotes for Prussic Acid. Small quantities of ammonia water diluted with 10 or 12 parts of water; also the fumes inhaled. The joint administration of carbonate of potash and sulphate of iron. This has been lately very strongly recommended. Cold affusion should be adopted in all cases, and is almost of itself a certain cure, if employed before the convulsive stage is over; and it is often successful even during the stage of insensibility and paralysis. Artificial respiration should also be attempted. Unfortunately, the poisonous action of prussic acid is so rapid that life is usually extinct before antidotes can be applied. (*See No.* 5913.)

5912. Antidotes for Strychnia and Nux-vomica. Evacuate the stomach with the stomach pump or emetics. (*See No.* 5896.) No antidote is known.

5913. Antidotes for Carbonic Acid Gas. When asphyxia from the inhalation of carbonic acid gas occurs, the patient should be immediately removed into the open air, and placed upon his back with the head slightly raised. Cold water should be dashed over the body, hot water applied to the feet, and ammonia to the nostrils. Brandy and water, and other stimulants, may be administered. Friction on the surface of the body is also recommended. If the patient has ceased to breathe, artificial respiration should be attempted. This may be done by pressing down the ribs, forcing up the diaphragm, and then suddenly withdrawing the pressure. (*See No.* 5893, *Rule V.*)

5914. Antidotes for Poisonous Mushrooms. The best antidote to poisonous mushrooms is tannin, or an infusion or decoction of galls. A strong emetic should also be given to remove them from the stomach.

5915. Antidote for Carbolic Acid. Dr. Crace Calvert states that the best antidote after the stomach pump is large doses of olive or almond oil, with a little castor oil. Oil is a solvent, and consequently a diluent of carbolic acid, and may be used to stop the corrosive effect of the acid when the action on the skin is too violent. Dr. Husemann, of Gottingen, suggests, for counteracting its effects on the stomach, a new preparation which he calls calcaria saccharata (*saccharate of lime*), prepared by dissolving 16 parts refined sugar in 40 parts water, and adding 5 parts slacked lime. Digest the mixture for 3 days, stir occasionally, filter, and evaporate to dryness.

5916. Antidote for Poisoning by Chlorine. Chlorine gas is an irritative poison, and the best antidotes are said to be ammoniacal gas, or the vapor of warm water, of wine, or of ether. The effects of chlorine have been known to pass off in the open air; leaving, in a certain instance, a violent cough, which disappeared in a few hours.

5917. Hodgen's Simple Stomach Pump. Attach 4 feet of india-rubber tubing to a stomach tube, fill both with water by simply dipping it in the liquid, end first, then compressing the elastic tube between the thumb and finger to keep the fluid from running out, introduce the stomach tube down the throat of the patient, lower the outer end of the elastic tube, and the contents of the stomach pour out as readily as if from an open vessel, the rubber tube acting as a syphon. When the fluid ceases to flow, dip the outer end of the tube beneath the surface of the water, elevate the vessel containing it above the level of the patient's mouth, and the stomach is soon filled; lower again the outer end of the tube and the stomach is emptied. This can, of course, be repeated as often as is necessary. The advantages claimed for this simple contrivance are, that it is of speedy and easy application, has no valves to become obstructed or deranged, and is far less expensive than a stomach pump.

5918. Cure for Ulcers Caused by Cyanide of Potassium. This substance is used in electroplating and other arts, and sometimes occasions ulcers on the hands. Protosulphate of iron in fine powder, ground in raw linseed oil, is recommended by a practical man, as the most effectual application for relieving the pain and healing the sores.

5919. Treatment for Hydrophobia. First dose, 1 ounce elecampane root, boiled in 1 pint milk until reduced to ½ pint. Second dose (to be taken 2 days after the first), 1½ ounces elecampane root in 1 pint of milk, boiled as the first. Third dose, the same as the second (to be taken 2 days after); in all, 3 doses. Mr. J. W. Woolston, a respectable citizen of Philadelphia, vouches for the above receipt. He says: "I have known of its being tried in one case, and no inconvenience has been felt. A friend of mine, of whom I obtained the receipt, knew of 20 instances where it was successfully given." We give the above for what it is worth, but we have no great faith in it.

5920. Cure for Hydrophobia. Cut out completely the wounded part before the poison can be absorbed. It is recommended, in order to do this quickly and thoroughly, that a stick be whittled to a shape resembling a dog's tooth, and inserted in the wound. This supports the part, and renders the cutting more easy and certain. This should be followed by cauterization, either by the use of a hot iron, or some strong caustic substance.

5921. To Remove the Virus in Hydrophobia. Suck the bitten part well, spitting out the fluid obtained from the wound; then apply some strong nitric acid, or lunar caustic, and bind the part up as tightly as the patient can bear it. Only one cauterization is needed.

5922. Youatt's Cure for Hydrophobia. Youatt (the great horse doctor) says he has been bitten eight or ten times and always cured himself by rubbing nitrate of silver in the wound. It should be applied as soon after the accident as may be. In 6 weeks the virus is disseminated through the system and then hope is gone.

5923. Preventive of Hydrophobia. The production of profuse perspiration is sometimes of great use in preventing the bad effects of a bite, so it should be tried.

5924. Ribron's Antidote to the Poison of the Rattlesnake. Iodide of potassium, 4 grains; corrosive sublimate, 2 grains; bromine, 5 drachms. 10 drops of this mixture, diluted with 1 or 2 table-spoonfuls of brandy, wine, or whiskey, constitute a dose, to be repeated if necessary. It must be kept in glass-stoppered phials, well secured, as the air will affect it. The salts may, in case of emergency, be first dissolved in a little water, before adding the bromine, as this dissolves them very slowly. This is a valuable remedy. Dr. Hammond, in speaking of the remedy, says that during a recent expedition to the Rocky Mountains, he had frequent opportunities to test its efficiency. The results were satisfactory, and he thinks that, when taken in time, it may be entirely depended upon in the poisonous wounds of the rattlesnake.

5925. To Extract the Poison from a Rattlesnake Bite. The most direct and efficient means of counteracting the absorption of the poison is suction, and this is most effectually done by exhausting a cupping-glass over the wound. The cupping-glass must be applied as soon after the injury as possible, and kept exhausted until all danger has passed. It has been proved that the bites of vipers, both on man and animals, were rendered entirely harmless by the application of these glasses.

5926. Cure for Snake Bites. As many as 8000 persons die annually in British India and Burmah, from the effects of snake bites. The Inspector of Police to the Bengal Government reports that of 939 cases in which ammonia was freely administered, 702 victims have recovered, and in the cured instances, the remedy was not administered till about 3½ hours after the attack, on the average. In the fatal cases, the corresponding duration of time was 4¼ hours.

5927. To Cure the Stings of Hornets, Wasps, Bees, and Spiders. Swelling may instantly be arrested by an application of equal parts common salt and bicarbonate of soda, dissolved in warm water, and well rubbed in on the place bitten or stung. (*See also No.* 5929.)

5928. Cure for Stings of Wasps, &c. Rub the part affected with a mixture of 1 part spirits of hartshorn and 2 parts olive oil.

5929. To Cure the Bites of Insects. Dissolve 1 ounce borax in 1 pint water that has been boiled and allowed to cool. Instead of plain water, distilled rose-water, elder, or orange-flower water is more pleasant. The bites are to be dabbed with the solution as long as there is any irritation. For bees' or wasps' stings the borax solution may be made of twice the above strength.

5930. To Cure Poisoning by Poison Ivy, Oak, or Sumach. Bathe the poisoned part thoroughly with hot water, without soap. When dry, paint the place liberally, 2 to 4 times a day, with a feather dipped in strong tincture of lobelia. Avoid bringing the tincture in contact with any fresh wound or excoriation.

5931. Remedy for Poison Ivy, &c. In some cases, where lobelia (*see last receipt*) does not succeed quickly, an application, in a similar manner, of fluid extract of gelseminum sempervirens (yellow jessamine) will rarely fail to cure. Both of these are excellent remedies, generally acting like magic.

5932. Remarks on Poison Ivy, &c. Poison ivy, &c., act very differently upon different people. Some people are entirely proof against its effects, and can, with impunity, rub it on without any ill effect. Others are poisoned by simple contact with clothing that has touched it. This difference of susceptibility to the poison seems to apply equally to the remedies, as what will cure one person has little or no effect on another.

5933. Applications for Poison Ivy. Various applications have been used for the same purpose; bathing the parts with a decoction of hemlock boughs, or of oak leaves; or with a table-spoonful of copperas (sulphate of iron) in a small tea-cupful of boiling water; or painting over with fresh lime-water; or rubbing wet salt on the poisoned part; or bathing the parts affected freely with spirit of nitre. If the blisters be broken, so as to allow the nitre to penetrate, more than a single application is rarely necessary. It will scarcely be possible to fail in finding, in one or other of the remedies here given, a means of cure suited to the party affected.

Tables of Weights, Measures, &c.

The following tables have been compiled for the purpose of aiding the reader to determine with facility, the relative values of different weights and measures; and to furnish in a convenient group a mass of valuable information that would otherwise have to be sought for in a number of volumes not easy of access. Most of the tables have been made expressly for this work, and all of them have been carefully recalculated, revised, and corrected by a competent mathematician.

5935. Avoirdupois Weight is employed for weighing all goods, except those for which Troy or Apothecaries weight are used. The ton is subdivided into hundred-weights, quarters, pounds, ounces, and drachms. (*See No.* 6031.) Some goods are sold by the hundred-weight of 100 pounds, instead of the hundred-weight (cwt.) of 112 pounds; a ton composed of 20 hundreds would then contain only 2000 pounds. The pound avoirdupois consists of 7000 Troy grains. The drachm avoirdupois is therefore 27.34375 Troy grains. The standard avoirdupois pound of the United States is the weight of 27.7015 cubic inches of distilled water, at 39.83° Fahr., the barometer being at 30 inches.

Ton.	Cwt.	Qrs.	Lbs.	Oz.	Dr.
1 =	20 =	80 =	2,240 =	35,840 =	573,440
	1 =	4 =	112 =	1,792 =	28,672
		1 =	28 =	448 =	7,168
			1 =	16 =	256
				1 =	16

5936. Equivalents of Avoirdupois in Troy Weight.

Avoirdupois.		Lbs.	Oz.	Dwt.	Grains.
1 Ton	=	2922	2	13	8
1 Cwt.	=	146	1	6	16
1 Qr.	=	34	0	6	16
1 Lb.	=	1	2	11	16
1 Oz.	=			18	5½
1 Dr.	=			1	3 11/32

5937. Value of Avoirdupois Weight in Apothecaries Measure.

		f℥	fʒ	♍
1 pound	=	15	2	53.3622
1 ounce	=		7	40.8351

5938. Value of Avoirdupois in Apothecaries Weight.

Avoirdupois.		Apothecaries.				
		℔	℥	ʒ	℈	Gr.
1 pound	=	1	2	4	2	0
1 ounce	=			7	0	17½
1 drachm	=				1	7 11/32

In the new British Pharmacopœia the weights are expressed in pounds, ounces, and grains avoirdupois. (*See No.* 6031.)

5939. Decimal Equivalents of lbs., qrs., and cwt.

qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.
0	0½	=.0044	1	0	=.25	2	0	=.5	3	0	=.75
0	1	.0089	1	1	.2589	2	1	.5089	3	1	.7589
0	2	.0178	1	2	.2678	2	2	.5178	3	2	.7678
0	3	.0268	1	3	.2768	2	3	.5268	3	3	.7768
0	4	.0357	1	4	.2857	2	4	.5357	3	4	.7857
0	5	.0446	1	5	.2946	2	5	.5446	3	5	.7946
0	6	.0535	1	6	.3035	2	6	.5535	3	6	.8035
0	7	.0625	1	7	.3125	2	7	.5625	3	7	.8125
0	8	.0714	1	8	.3214	2	8	.5714	3	8	.8214
0	9	.0803	1	9	.3303	2	9	.5803	3	9	.8303
0	10	.0892	1	10	.3392	2	10	.5892	3	10	.8392
0	11	.0982	1	11	.3482	2	11	.5982	3	11	.8482
0	12	.1071	1	12	.3571	2	12	.6077	3	12	.8571
0	13	.1160	1	13	.3660	2	13	.6160	3	13	.8660
0	14	.125	1	14	.375	2	14	.625	3	14	.875
0	15	.1339	1	15	.3839	2	15	.6339	3	15	.8839
0	16	.1429	1	16	.3929	2	16	.6429	3	16	.8929
0	17	.1518	1	17	.4018	2	17	.6518	3	17	.9018
0	18	.1607	1	18	.4107	2	18	.6607	3	18	.9107
0	19	.1696	1	19	.4196	2	19	.6696	3	19	.9196
0	20	.1786	1	20	.4286	2	20	.6786	3	20	.9286
0	21	.1875	1	21	.4375	2	21	.6875	3	21	.9375
0	22	.1964	1	22	.4464	2	22	.6964	3	22	.9464
0	23	.2054	1	23	.4554	2	23	.7054	3	23	.9554
0	24	.2143	1	24	.4643	2	24	.7143	3	24	.9643
0	25	.2232	1	25	.4732	2	25	.7232	3	25	.9732
0	26	.2321	1	26	.4821	2	26	.7321	3	26	.9821
0	27	.2411	1	27	.4911	2	27	.7411	3	27	.9911

5940. Decimal Equivalents of Pounds and Ounces.

oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.
¼	.015625	3	.1875	6½	.40625	10	.625	13½	.84375
½	.03125	3½	.21875	7	.4375	10½	.65625	14	.875
¾	.046875	4	.25	7½	.46875	11	.6875	14½	.90625
1	.0625	4½	.28125	8	.5	11½	.71875	15	.9375
1½	.09375	5	.3125	8½	.53125	12	.75	15½	.96875
2	.125	5½	.34375	9	.5625	12½	.78125	16	1.
2½	.15625	6	.375	9½	.59375	13	.8125		

5941. Avoirdupois Weight Expressed in Grams.

Avoirdupois.		Grams.		
1 Ton	=	1,015,938.84	=	1.016 Milliers
1 Cwt.	=	50,796.94	=	5.080 Myriagrams
1 Quarter	=	12,699.23	=	1.270 Myriagrams
1 Pound	=	453.54	=	4.535 Hectograms
1 Ounce	=	28.34	=	2.834 Dekagrams
1 Drachm	=	1.77		

5942. Troy Weight is used by jewelers for weighing gold, silver, platina, and all precious stones except the diamond; and is the weight adopted by the mint. The pound Troy contains 5.760 grains.

Pound.		Ounces.		Pennyweights.		Grains.
1	=	12	=	240	=	5760
		1	=	20	=	480
				1	=	24
						1

5943. Diamond Weight. Diamonds are weighed by a separate method; the carat, equivalent to 3.2 grains Troy, is thus subdivided.

Carat.		Grains.		Parts.		Troy Grains.
1	=	4	=	16	=	3.2
		1	=	4	=	.8
				1	=	.2

5944. Troy Weight Compared with Avoirdupois.

Troy.		Avoirdupois. Oz.	Avoirdupois. Dr.
1 Pound	=	13	2.65
1 Ounce	=	1	1.55
1 Dwt.	=		0.877

5945. Equivalents of Troy in Apothecaries Weight.

Troy.		℔	℥	ʒ	℈	Gr.
1 Pound	=	1	0	0	0	0
1 Ounce	=		1	0	0	0
1 Dwt.	=				1	4
1 Grain	=					1

5946. Troy Weight Expressed in Grams.

Troy.		Grams.
1 Pound	=	373.202, or 3.732 Hectograms
1 Ounce	=	31.100, or 3.110 Dekagrams
1 Dwt.	=	1.555
1 Grain	=	.0648, or 6.48 Centigrams.

5947. Approximate Values of Troy in Metrical Weight.

Troy weight.		Weight.		Measure.
32 oz.	=	1 kilogramme,	=	1 litre.
16 oz.	=	½ kilog. = 500 grams,	=	.500 "
4 oz.	=	125 grams.	=	.125 "
1 oz.	=	32 grams,	=	.32 "
1 dr'm.	=	4 grams,	=	.4 "
15 grains	=	1 gram,	=	.1 cubic centimetre.
1½ gr'ns	=	1 decigram.		

5948. Assayer's Gold Weights. The richness or purity of gold is expressed in carats. Pure gold is spoken of as containing 24 carats, of 12 grains each; and any sample containing 12, 18, 22, or any other number of parts of pure gold, in 24 parts, is said to be of so many carats fine. In the process of assaying gold, the real quantity taken is very small, generally 6 or 12 grains; and this is termed the "assay pound." It is nominally subdivided into 24 carats, and each carat into 4 assay grains, and each grain into quarters. When the assay pound is only 6 grains, the quarter of the assay grain will only weigh the $\frac{1}{64}$ of a grain; hence the most accurate system of weighing must be adopted.

5949. Assayer's Silver Weights. The richness or purity of silver is either expressed in pennyweights or $\frac{1}{1000}$. In the first case, it is supposed that the mass of silver to be examined consists of 12 equal parts, called pennyweights; so that if an ingot weighs an ounce, each of the parts will be $\frac{1}{12}$ of an ounce. Hence, if the mass of silver be pure, it is called silver of 12 pennyweights; if it contain $\frac{1}{12}$ of its weight of alloy, it is called silver of 11 pennyweights; if $\frac{2}{12}$ of its weight be alloy, it is called silver of 10 pennyweights; and so on in proportion for other qualities. It must be observed here, that the assayers give the name pennyweight to a weight equal to 24 real grains, which must not be confounded with their ideal weights. The assayer's grains are called fine grains. An ingot of fine silver, or silver of 12 pennyweights, contains, then, 288 fine grains; if this ingot contain $\frac{1}{288}$ of alloy, it is said to be silver of 11 pennyweights and 23 grains; if it contain $\frac{4}{288}$ of alloy, it is said to be 11 pennyweights, 20 grains, &c. The purity of silver is now more frequently expressed in $\frac{1}{1000}$, which admits of greater accuracy.

5950. Table for Converting Troy into Avoirdupois Weight.

Troy Ounces.		Avoirdupois Ounces.	Avoirdupois Grains.
1	=	1	42½
2	=	2	85
3	=	3	127½
4	=	4	170
5	=	5	212½
6	=	6	255
7	=	7	297½
8	=	8	340
9	=	9	382½
10	=	10	425
11	=	12	30
12	=	13	72½

175 Troy ounces are equal to 192 avoirdupois.

Troy. ℔		Avoirdupois. ℔	Oz.	Gr.
1	=	0	13	72½
2	=	1	10	145
3	=	2	7	217½
4	=	3	4	290
5	=	4	1	362½
6	=	4	14	435
7	=	5	12	70
8	=	6	9	142½
9	=	7	6	215
10	=	8	3	287½
11	=	9	0	360
12	=	9	13	432½
13	=	10	11	67½
14	=	11	8	140
15	=	12	5	212½
16	=	13	2	285
17	=	13	15	357½
18	=	14	12	430
19	=	15	10	65
20	=	16	7	137½
30	=	24	10	425
40	=	32	14	275
50	=	41	2	125
60	=	49	5	412½
70	=	57	9	262½
80	=	65	13	112½
90	=	74	0	400
100	=	82	4	250
175	=	144	0	0
200	=	164	9	62½
300	=	246	13	312½
400	=	329	2	125
500	=	411	6	375
1000	=	822	13	312½

5951. Apothecaries Weight is a subdivision of the Troy pound into ounces, drachms, scruples, and grains. It is used in compounding medicines, and is the officinal standard of the U. S. Pharmacopœia.

℔		℥		ʒ		℈		Grs.
1	=	12	=	96	=	288	=	5760
		1	=	8	=	24	=	480
				1	=	3	=	60
						1	=	20
								1

5952. Apothecaries Weight Compared with Avoirdupois Weight.

Apothecaries.		Avoirdupois. Oz.	Avoirdupois. Dr.
1 Pound	=	13	2.65
1 Ounce	=	1	1.55
1 Drachm	=		2.19
1 Scruple	=		0.73

5953. Apothecaries Weight Compared with Troy Weight.

Apothecaries.		Troy.			
		Lb.	Oz.	Dwt.	Gr.
1 Pound	=	1	0	0	0
1 Ounce	=		1	0	0
1 Drachm	=			2	12
1 Scruple	=				20

5954. Value of Apothecaries Weight in Apothecaries Measure.

Weight		f℥	fʒ	♏
1 Pound	=	12	5	7.2238
1 Ounce	=	1	0	25.6020
1 Drachm	=	0	1	3.2002
1 Scruple	=	0	0	21.0667
1 Grain	=	0	0	1.0533

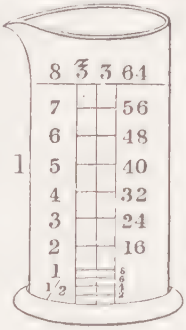
5955. Apothecaries Weight Expressed in Grams.

1 Pound = 3.732 Hectograms
1 Ounce = 3.110 Dekagrams
1 Drachm = 3.887 Grams
1 Scruple = 1.296 “
1 Grain = 6.4 Centigrams.

5956. Apothecaries, or Wine Measure, is the gallon of liquid measure divided into pints, fluid ounces, fluid drachms, and minims. The minim being equivalent to one drop of water. The symbols or abbreviations used in this table will be found explained in No. 5964. In all the tables of comparison between apothecaries measure and avoirdupois or other weights, the basis assumed is the weight of a cubic inch of water at a temperature of 39.83° Fahr., the barometer being at 30 inches, and is equivalent to 252.693 Troy grains. A *grain measure* is the capacity or bulk of a grain of water weighed at its maximum density; a grain measure of any fluid, therefore, weighs more or less than a grain, according as its specific gravity is greater or less than water at standard temperature.

Cong.		O.		f℥		fʒ		♏		Cubic Inches.
1	=	8	=	128	=	1024	=	61440	=	231
		1	=	16	=	128	=	7680	=	28.875
				1	=	8	=	480	=	1.8047
						1	=	60	=	.2256
								1	=	.0376

5957. Graduated Fluid Measures. Fluids are measured by means of glass vessels having a graduated scale engraved on their sides. These are of different capacities, to measure 8 ounces, 2 ounces, 1 ounce and 1 drachm respectively; the scale of each being graduated to represent the aliquot parts of their respective capacities.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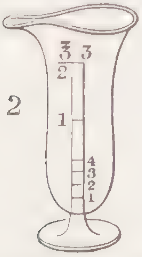

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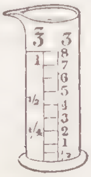

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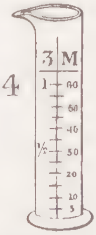


No. 1 represents an 8-ounce measure; the figures on the left of the graduated scale denote ounces, and those on the right, drachms; the first ounce being divided into quarters of 2 drachms each. No. 2 is a 2-ounce measure, the first half-ounce being divided into drachms. Nos. 3 and 4 are 1 ounce and 1 drachm measures respectively; the former is graduated in drachms, the first of which is divided into halves; the latter is marked in divisions of 5 minims each.

5958. Relative Value of U. S. Apothecaries and British Imperial Measure. (*See No.* 6031.)

U. S. Apothecaries Measure.			Imperial Measure.						
						Pints.	Fl.oz.	Fl.dr.	Minims.
1 Gallon	=	.83311	Imp.	Gallon,	or,	6	13	2	22.85
1 Pint	=	.83311	“	Pint,	or,		16	5	17.86
1 Fl.Oz.	=	1.04139	“	Fl.Oz.,	or,		1	0	19.87
1 Fl.Dr.	=	1.04139	“	Fl.Dr.,	or,			1	2.48
1 Minim	=	1.04139	“	Minim,	or,				1.04

5959. Apothecaries Measure Expressed in Litres.

1 Gallon = 3.78515 Litres.
1 Pint = 4.73143 Decilitres
1 Fluid ounce = 2.95715 Centilitres
1 Fluid drachm = 3.69644 Millilitres
1 Minim = .06160 “

5960. Value of Apothecaries Measure in Avoirdupois Weight.

1 Gallon = 8.332698 Pounds
1 Pint = 1.041587 Pounds
1 Fluid Ounce = 1.041587 Ounces

5961. Value of Apothecaries Measure in Troy Weight.

Apothecaries Measure.		Troy Weight.			
		Lbs.	Oz.	Dwt.	Grains.
1 Gallon	=	10	1	10	8.88
1 Pint	=	1	3	3	19.11
1 Fluid Ounce	=			18	23.69
1 Fluid Drachm	=			2	8.96
1 Minim	=				.95

5962. Value of Apothecaries Measure in Apothecaries Weight.

Measure.		℔	℥	ʒ	℈	Grains		Grains
1 Gallon	=	10	1	4	0	8.88	=	58328.886
1 Pint	=	1	3	1	1	11.11	=	7291.1107
1 Fluid ounce	=			7	1	15.69	=	455.6944
1 Fluid drachm	=				2	16.96	=	56.9618
1 Minim								.9493

5963. Miscellaneous Measures and their Equivalents.

Tea-spoonful	about	1	fl. drachm.
Dessert “	“	2	“
Table “	“	4	“
Wine-glassful	“	2	fl. ounces.
Tea-cupful	“	4	“
Breakfast-cupful	“	8	“
Tumblerful	“	8	“
Thimbleful	“	¾	fl. drachm.
Pinch (of leaves and flowers)	“	1	dr. (Troy).
Handful “	“	10	“

5964. Signs and Abbreviations Used in Medical Prescriptions.

℞	Recipe	Take
āā	Ana	Of each
℔	Libra	Pound
℥	Uncia	Ounce
ʒ	Drachma	Drachm
℈	Scrupulus	Scruple
Cong.	Congius	Gallon
O.	Octarius	Pint
f℥	Fluid Uncia	Fluid Ounce
fʒ	Fluid Drachma	Fluid Drachm
♏	Minimum	Minim
Chart.	Chartula	Small paper
Coch.	Cochlear	Spoonful

Collyr.	Collyrium	Eye-water
Decot.	Decoctum	Decoction
Ft.	Fiat	Make
Garg.	Gargarysma	Gargle
Gr.	Granum	Grain
Gtt.	Gutta	Drop
Haust.	Haustus	Draught
Infus.	Infusum	Infusion
M.	Misce	Mix
Mass.	Massa	Mass
Mist.	Mistura	Mixture
Pulv.	Pulvis	Powder
Q. S.	Quantum Sufficit	Sufficient Quantity
S.	Signa	Write
S. S.	Semis	Half

5965. Strength of Doses at Different Ages. The following gradations for doses of medicines apportioned to the age of the patient were originally drawn up by Gaubius.

Under	½ year	$\frac{1}{16}$	of a full dose.
"	1 "	$\frac{1}{12}$	"
"	2 years	$\frac{1}{8}$	"
"	3 "	$\frac{1}{6}$	"
"	4 "	$\frac{1}{5}$	"
"	7 "	$\frac{1}{3}$	"
"	14 "	$\frac{1}{2}$	"
"	20 "	$\frac{2}{3}$	"
Above	21 "	the full dose.	
"	63 "	$\frac{11}{12}$	"
"	77 "	$\frac{5}{6}$	"
"	100 "	$\frac{2}{3}$	"

Dr. Young gives the following simple formula: For children under 12 years, the doses of most medicines must be diminished in the proportion of the age to the age increased by 12. Thus, at 2 years, the dose will be $\frac{1}{7}$ of that for an adult, viz:

$$\frac{2}{2+12}=\frac{1}{7}$$

Sex, temperament, constitutional strength, and the habits and idiosyncrasies of individuals, must be taken into account. Nor does the same rule apply to all medicines. Calomel, for instance, is generally borne better by children than by adults; while opium affects them more powerfully, and requires the dose to be diminished considerably below that indicated above.

5966. Liquid Measure. This is used for all liquids which are sold by measure. The United States Government standard gallon, adopted by the Treasury Department in 1832, has a capacity of 231 cubic inches, and contains 58,372.2 troy grains of distilled water, at 39.83° Fahr., the temperature of its maximum density.

Gal.	Quarts.	Pints.	Gills.	Cubic Inches.
1 =	4 =	8 =	32 =	231
	1 =	2 =	8 =	57.75
		1 =	4 =	28.875
			1 =	7.2175

A Barrel	contains		31½	gallons.
A Tierce	"		42	"
A Puncheon	" 2 tierces,	or	84	"
A Hogshead	" 2 barrels,	or	63	"
A Pipe	" 2 hogsheads,	or	126	"
A Tun	" 2 pipes,	or	252	"

5967. Liquid Measure Compared with Apothecaries Measure. The gallon and pint are the same in both measures. A liquid gill contains 4 fluid ounces, or 32 fluid drachms, or 1920 minims.

5968. Relative Value of U. S. Liquid Measure in English Imperial Measure.

U. States.	Imperial.	Quart.	Pint.	Gill.
1 Gallon	= .83311 gal., or	3	0	2.66
1 Quart	= .83311 qt., or		1	2.66
1 Pint	= .83311 pt., or			3.33
1 Gill	= .83311 gill, or			0.83

5969. Liquid Measure Expressed in Litres.

1 Gallon = 3.785148 Litres
1 Quart = 9.46287 Decilitres
1 Pint = 4.73143 "
1 Gill = 1.18286 "

5970. Dry Measure. The Winchester bushel, formerly used in England, contained 2150.42 cubic inches; this was superseded in 1826 by the Imperial bushel of 2218.192 inches, or 80 pounds of distilled water at 62° Fahr., and the barometer at 30 inches. In the United States, the Winchester bushel of 2150.42 inches has been generally adopted, which holds 77.627413 pounds of distilled water at 39.83° Fahr., the temperature of its maximum density, and 30 inches barometric pressure. In New York the bushel is declared to contain 80 pounds distilled water at its maximum density, under the mean pressure of the atmosphere at the level of the sea. This would make the New York bushel contain 2216.128 cubic inches, somewhat less than the Imperial bushel, owing to the different standard of temperature of the water. The "small measure" used in the markets should contain 2 quarts, or ¼ peck.

Quarter.	Bushels.	Pecks.	Quarts.	Pints.	Capacity in Cubic Inches.
1 =	8 =	32 =	256 =	512 =	17203.36
	1 =	4 =	32 =	64 =	2150.42
		1 =	8 =	16 =	537.605
			1 =	2 =	67.200
				1 =	33.600

5971. Dry Measure expressed in Litres.

1 Bushel = 35.23661 Litres
1 Peck = 8.80915 "
1 Quart = 1.10114 "
1 Pint = .55057 "

5972. Relative Value of United States Dry Measure and Imperial Dry Measure.

United States.	Imperial.	Imperial Bush.	Pecks.	Gals.	Pints.
1 Quarter	= .96945 quarter, or	7	3	0	.36
1 Bushel	= .96945 bushel, or		3	1	6.04
1 Peck	= .96945 peck, or			1	7.51
1 Quart	= .24236 gallon, or				1.94
1 Pint	= .96945 pint, or				.97

5973. Weight of a Barrel of Various Articles. Some things which are sold by weight or measure are also sold by the *Barrel*, the quantity being different for different articles. The weights are here given. For rice, 600 pounds. Flour, 196 pounds. Powder, 25 pounds. Corn, as bought and sold in Kentucky, Tennessee, &c., 5 bushels of shelled corn. As bought and sold at New Orleans, a flour-barrel full of ears. Potatoes, as sold in New York, a barrel contains 2¼ bushels. Pork, a barrel is 200 pounds, distinguished in quality by "clear," "mess," "prime." A barrel of beef is the same weight.

5974. Weight of a Bushel of Various Commodities. The term bushel is also applied to a certain arbitrary weight varying with different articles. Wheat, beans, potatoes, and clover seed, 60 pounds to the bushel. Corn, rye, flax-seed, and onions, 56 pounds.

Corn on the cob, 70 pounds. Buckwheat, 52 pounds. Barley, 48 pounds. Hemp seed, 44 pounds. Timothy seed, 45 pounds. Castor beans, 46 pounds. Oats, 35 pounds. Bran, 20 pounds. Blue grass seed, 14 pounds.

5975. Lineal or Long Measure. The standard of linear measurements, by which all measures of capacity are also regulated, is derived from the length of a pendulum vibrating seconds in a vacuum. This, in the latitude of London, is equal to 39.1393 inches, and in the City Hall of New York, 39.1012 inches.

By scientific persons, parts of an inch are represented by a decimal fraction, but for mechanical purposes the inch is divided into a half, quarters and eighths.

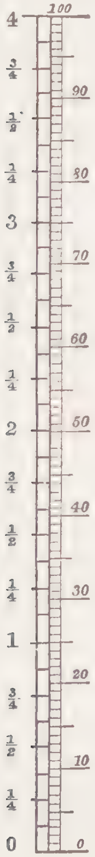
Mile.	Furlongs.	Rods.	Yards.	Feet.	Inches.
1 =	8 =	320 =	1760 =	5280 =	63360
	1 =	40 =	220 =	660 =	7920
		1 =	5½ =	16½ =	198
			1 =	3 =	36
				1 =	12

5976. Long Measure Expressed in Metres.

	Metres.	
1 Mile =	1609.30634 =	1.609 Kilometres
1 Furlong =	201.16329 =	2.012 Hectometres
1 Rod =	5.02908 =	5.029 Metres
1 Yard =	.91438 =	9.144 Decimetres
1 Foot =	.30479 =	3.048 Decimetres
1 Inch =	.02539 =	2.539 Centimetres

5977. Comparative Scale of Inches in French Metres.

Inches. Millimetres.



5978. Value of Inches and Feet in French Metres.

Inches.	
⅛ =	.00317
$\frac{3}{16}$ =	.00475
¼ =	.00635
$\frac{5}{16}$ =	.00794
⅜ =	.00952
$\frac{7}{16}$ =	.01111
½ =	.01269
$\frac{9}{16}$ =	.01428
⅝ =	.01586
$\frac{11}{16}$ =	.01745
¾ =	.01904
$\frac{13}{16}$ =	.02063
⅞ =	.02221
$\frac{15}{16}$ =	.02379
1 =	.02539
2 =	.05079
3 =	.07619
4 =	.10159
5 =	.12699
6 =	.15239
7 =	.17779
8 =	.20319
9 =	.22859
10 =	.25399
11 =	.27939
12 =	.30479
Feet.	
2 =	.60958
3 =	.91438
4 =	1.21916
5 =	1.52395
6 =	1.82874
7 =	2.13353
8 =	2.43832
9 =	2.74311
10 =	3.04791
11 =	3.35270
12 =	3.65750

5979. Decimal Equivalents of Fractional Parts of an Inch.

Decimals.		Parts of an Inch.	Decimals.		Parts of an Inch.
.03125	=	$\frac{1}{32}$	.53125	=	$\frac{17}{32}$
.06250	=	$\frac{1}{16}$	.56250	=	$\frac{9}{16}$
.09375	=	$\frac{3}{32}$	.59375	=	$\frac{19}{32}$
.12500	=	⅛	.62500	=	⅝
.15625	=	$\frac{5}{32}$	.65625	=	$\frac{21}{32}$
.18750	=	$\frac{3}{16}$	.68750	=	$\frac{11}{16}$
.21875	=	$\frac{7}{32}$	.71875	=	$\frac{23}{32}$
.25000	=	¼	.75000	=	¾
.28125	=	$\frac{9}{32}$	.78125	=	$\frac{25}{32}$
.31250	=	$\frac{5}{16}$	.81250	=	$\frac{13}{16}$
.34375	=	$\frac{11}{32}$	.84375	=	$\frac{27}{32}$
.37500	=	⅜	.87500	=	⅞
.40625	=	$\frac{13}{32}$	.90625	=	$\frac{29}{32}$
.43750	=	$\frac{7}{16}$	.93750	=	$\frac{15}{16}$
.46875	=	$\frac{15}{32}$	.96875	=	$\frac{31}{32}$
.50000	=	½			

5980. Pendulum Measure. 6 points = 1 line. 12 lines = 1 inch.

5981. Shoemakers' Measures. No. 1 is 4⅛ inches in length, and every succeeding number is ⅛ inch. There are 28 divisions, in two series of numbers, viz.: from 1 to 13 and 1 to 15.

5982. Square or Superficial Measure.

Acre.	Roods.	Poles.	Yards.	Feet.	Inches.
1 =	4 =	160 =	4,840 =	43,560 =	6,272,640
	1 =	40 =	1,210 =	10,890 =	1,568,160
		1 =	30¼ =	272¼ =	39,204
			1 =	9 =	1,296
				1 =	144

5983. Square Measure in Square Metres.

1 Acre =	4046.66700	sq. metres =	40.46667	Ares
1 Rood =	1011.66675	" =	10.11667	"
1 Pole =	25.29167	" =	25.29167	Centares
1 Yard =	.83609	" =	.83609	"
1 Foot =	.09289	" =	9.289	Milliares
1 Inch =	.000645	" =	.0645	"

5984. Government Land Measure. A Township—36 sections, each a mile square. A Section—640 acres. A Quarter Section, half a mile square—160 acres. An Eighth Section, half a mile long, north and south, and a quarter of a mile wide—80 acres. A Sixteenth Section, a quarter of a mile square—40 acres. The Sections are all numbered one to thirty-six, commencing at the northeast corner, thus:

6	5	4	3	2	NW NE SW SE
7	8	9	10	11	12
18	17	16*	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

The Sections are all divided in quarters, which are named by the cardinal points, as in section 1. The quarters are divided in the same way.

*School Section.

5985. Decimal Equivalents of the Divisions of a Foot.

	0	1	2	3	4	5	6	7	8	9	10	11
		.08333	.16666	.25	.33333	.41666	.5	.58333	.66666	.75	.83333	.91666
1/16	.00521	.08854	.17187	.25521	.33854	.42187	.50521	.58854	.67187	.75521	.83854	.92187
1/8	.01041	.09374	.17707	.26041	.34374	.42707	.51041	.59374	.67707	.76041	.84374	.92708
3/16	.01562	.09895	.18228	.26562	.34895	.43228	.51562	.59895	.68228	.76562	.84895	.93229
1/4	.02083	.10416	.18750	.27083	.35416	.43759	.52083	.60416	.68750	.77083	.85416	.93750
5/16	.02604	.10937	.19270	.27604	.35937	.44270	.52604	.60937	.69270	.77604	.85937	.94270
3/8	.03125	.11458	.19791	.28125	.36458	.44791	.53125	.61458	.69791	.78125	.86458	.94791
7/16	.03646	.11979	.20312	.28646	.36979	.45312	.53646	.61979	.70312	.78646	.86979	.95312
1/2	.04166	.12500	.20832	.29166	.37500	.45833	.54166	.62500	.70832	.79166	.87500	.95833
9/16	.04687	.13020	.21353	.29687	.38020	.46354	.54687	.63020	.71353	.79687	.88020	.96354
5/8	.05208	.13541	.21874	.30208	.38541	.46875	.55208	.63541	.71874	.80208	.88541	.96875
11/16	.05729	.14062	.22395	.30729	.39062	.47395	.55729	.64062	.72395	.80729	.89062	.97395
3/4	.06250	.14583	.22916	.31250	.39583	.47916	.56250	.64583	.72916	.81250	.89583	.97916
13/16	.06771	.15104	.23437	.31771	.40104	.48437	.56771	.65104	.73437	.81771	.90104	.98437
7/8	.07292	.15625	.23958	.32292	.40625	.48958	.57292	.65625	.73958	.82292	.90625	.98958
15/16	.07813	.16146	.24479	.32813	.41146	.49479	.57813	.66146	.74479	.82813	.91146	.99479

To use the above table—suppose it is required to find what decimal of a foot is equivalent to 8 inches—look for the column headed 8, and the figures at the top of that column, .66666, is the decimal required. Again, to find the decimal of a foot equal to 5¾ inches, look in the column under figure 5, run the finger down that column until it is level with the ¾ (marked on the left side of the table); the figures .47916 give the decimal required.

5986. To Find the Square Feet in Boards. Multiply the decimal in the table, corresponding to the width of the board, by the length of the board in feet.

Breadth in Inches.	Area of a Lineal Foot.	Breadth in Inches.	Area of a Lineal Foot.
¼	.0208	6¼	.5208
½	.0417	6½	.5416
¾	.0625	6¾	.5625
1	.0834	7	.5833
1¼	.1042	7¼	.6042
1½	.125	7½	.625
1¾	.1459	7¾	.6458
2	.1667	8	.6667
2¼	.1875	8¼	.6875
2½	.2084	8½	.7084
2¾	.2292	8¾	.7292
3	.25	9	.75
3¼	.2708	9¼	.7708
3½	.2916	9½	.7917
3¾	.3125	9¾	.8125
4	.3334	10	.8334
4¼	.3542	10¼	.8542
4½	.375	10½	.875
4¾	.3958	10¾	.8959
5	.4167	11	.9167
5¼	.4375	11¼	.9375
5½	.4583	11½	.9583
5¾	.4792	11¾	.9792
6	.5		

Example. To find the square feet in a board 14½ feet long and 9¼ inches wide.

The decimal in the table opposite 9¼ inches is .7708

Multiply by 14½

30832
7708
3854

Answer 11.1766 feet.
Or about 11⅙ feet.

5987. To Find the Square Surface or Area of a Circle. Square the radius (half the diameter), and multiply that by 3.14159; for small calculations 3⅐ is nearly the same as 3.14159. Thus, to find the area of a circle whose diameter is 8 feet: The radius is 4 feet, this squared is 16; then 16 times 3.14159 is 50.265 square feet. If the diameter is 8 inches, the area would be 50.265 square inches.

5988. Table Showing the Square Inches Contained in a Circle from Ten to Seventy-Three Inches in Diameter.

Diameter of Circle.	Square Inches.	Diameter of Circle.	Square Inches.
10	78.54	42	1388.59
11	95.03	43	1452.20
12	113.10	44	1520.53
13	132.73	45	1590.43
14	153.94	46	1661.91
15	176.71	47	1735.00
16	201.06	48	1809.56
17	226.98	49	1885.74
18	254.47	50	1963.50
19	283.54	51	2042.82
20	314.16	52	2123.72
21	346.36	53	2206.19
22	380.13	54	2290.23
23	415.47	55	2375.83
24	452.39	56	2463.00
25	490.88	57	2551.76
26	530.93	58	2642.00
27	572.56	59	2734.00
28	615.75	60	2827.44
29	660.20	61	2922.47
30	706.86	62	3019.00
31	754.77	63	3117.25
32	804.25	64	3217.00
33	855.30	65	3318.31
34	907.92	66	3421.20
35	962.00	67	3526.66
36	1017.88	68	3651.69
37	1075.20	69	3739.29
38	1134.00	70	3848.46
39	1194.60	71	3959.20
40	1256.64	72	4071.51
41	1320.26	73	4185.40

The area may also be obtained by multiplying the square of the diameter by .7854. This method is deduced from the first one, and is founded on the fact that the square of any number is always 4 times as much as the square of half the number. In the first method the radius or *half diameter* is to be squared, and multiplied by 3.14159; in the second, the *whole diameter* is squared, which will result in just 4 times as much as the square of the radius; the multiplier must be therefore the fourth part of 3.14159, or .7854.

5989. To Find the Area of a Parallelogram or Square. Multiply the length of one side by the perpendicular height.

5990. To Find the Area of a Triangle. Multiply the base by ½ the perpendicular height. Or, to find the area from three sides given, from the half sum of the three sides subtract each side separately; multiply the half sum and the three remainders together, and the square root of the product will be the area.

5991. To Find the Area of a Trapezoid. Multiply the sum of the two parallel sides by ½ the perpendicular height.

5992. To Find the Area of a Sector of a Circle. Multiply the radius of the circle by ½ the arc of the sector.

5993. To Find the Area of a Segment of a Circle. Find the area of a sector of a circle having the same arc, and deduct the triangle formed between the two radii and the chord of the arc.

5994. Cloth Measure, used for measuring dry goods.

Yard.		Quarters.		Nails.		Inches.
1	=	4	=	16	=	36
		1	=	4	=	9
				1	=	2¼

The height of horses is measured by the "hand" of 4 inches.

5995. Gunter's Chain. This is the measure generally adopted in land surveying, is 22 yards in length, and contains 100 links, each link, consequently being 7.92 inches long. The length of the chain was fixed at 22 yards, because a square whose side is 22 yards (1 chain) contains exactly $\frac{1}{10}$ acre; in other words, a rectangular plot of ground 1 chain in width and 10 chains in length contains an acre. 80 chains make 1 mile in length; and, consequently, a square mile contains 640 acres. For surveying and laying out plots and building lots, a chain of 50 feet, or one of 25 feet (the usual frontage of a lot) is usually employed by surveyors.

5996. Cubic or Solid Measurement.

Yard.		Feet.		Inches.
1	=	27	=	46,656
		1	=	1,728

5997. American Cord-Wood Measure. Timber is measured by the ton of 50 cubic feet of round, or 40 cubic feet of hewn timber. Cord-wood is measured by the cord, which consists of a pile 8 lineal feet long and 4 feet high; and, as the wood is reckoned to be 4 feet in length, contains 128 cubic feet. A stick of cord-wood should measure 4 feet 4 inches from end to end, to compensate for the slope or bevil of the cut, and provide for an equivalent of 4 feet of solid wood. The contents of each lineal foot of the length of the pile is called a cord foot, and contains one-eighth part of a cord, or 16 cubic feet. A New York load of wood is one-third of a cord.

A shipping ton contains 42 cubic feet.

Also, the cubic foot being considered unity, or 1, a cylinder 1 foot in diameter and 1 foot in length = .7854.

A sphere 1 foot in diameter = .5236.

A cone 1 foot in diameter at the base and 1 foot in height = .2619.

5998. Cubic Measure in Cubic Metres.

1 Yard = .76450 Cubic Metres
1 Foot = 28.31486 Cubic Decimetres
1 Inch = 16.38591 Cubic Centimetres

5999. Table of Solid Feet reduced to Solid Inches.

Feet.	Inches.	Feet.	Inches.	Feet.	Inches.
2=	3456	35=	60480	68=	117504
3	5184	36	62208	69	119232
4	6912	37	63936	70	120960
5	8640	38	65664	71	122688
6	10368	39	67392	72	124416
7	12096	40	69120	73	126144
8	13824	41	70848	74	127872
9	15552	42	72576	75	129600
10	17280	43	74304	76	131328
11	19008	44	76032	77	133056
12	20736	45	77760	78	134784
13	22464	46	79488	79	136512
14	24192	47	81216	80	138240
15	25920	48	82944	81	139968
16	27648	49	84672	82	141696
17	29376	50	86400	83	143424
18	31104	51	88128	84	145152
19	32832	52	89956	85	146880
20	34560	53	91584	86	148608
21	36288	54	93312	87	150336
22	38016	55	95040	88	152064
23	39744	56	96768	89	153792
24	41472	57	98496	90	155520
25	43200	58	100224	91	157248
26	44928	59	101952	92	158976
27	46656	60	103680	93	160704
28	48384	61	105408	94	162432
29	50112	62	107136	95	164160
30	51840	63	108864	96	165888
31	53568	64	110592	97	167616
32	55296	65	112320	98	169344
33	57024	66	114048	99	171072
34	58752	67	115776	100	172800

6000. Measurement of Stone and Brick-Work.

1 *Perch, Masons' or Quarrymen's Measure.*

16½ feet long, 16 inches wide, 12 " high, } = { 22 cubic feet. To be measured in wall.

16½ feet long, 18 inches wide, 12 " high, } = { 24.75 cubic feet. To be measured in pile.

1 cubic yard = 3 feet×3 feet×3 feet = 27 cubic feet. The cubic yard has become the standard for all contract work of late years. Stone walls less than 16 inches thick count as if 16 inches thick to mason; over 16 inches thick, each inch additional is measured.

Number of Bricks required in Walls for each Square Foot of Face of Wall.

Thickness of Wall.		Thickness of Wall.	
4 inches	7½	24 inches	45
8 "	15	28 "	52½
12 "	22½	32 "	60
16 "	30	36 "	67½
20 "	37½	42 "	75

Cubic yard = 600 bricks in wall.

Perch (22 cubic feet) = 500 bricks in wall.

To pave 1 sq. yard on flat requires 41 bricks.

" 1 " edge " 68 "

6001. To Find the Cubical Contents of a Cylinder. Find the area of the circular end, as directed in No. 5987, and then multiply the area by the length of the cylinder; the product will be the cubical content. The same denomination of measurement must be adhered to throughout the calculation, as, if the diameter or area is in inches, the length must be in inches. Thus: to find the cubical content of a cylinder 8 inches in diameter and 3 feet long; we find in No. 5987 that the area of a circle 8 inches in diameter is 50.265 square inches; multiply this by 36 inches (3 feet reduced to inches, the same denomination as the given diameter), and the product is 1809.54 cubic inches, or 1 foot, 81.54 cubic inches.

6002. Table of Spherical Contents, &c. This table shows the relative proportions between the diameter, surface, and capacity (or cubical contents) of spheres.

Diameters.	Surfaces.	Capacities.
1	3.141	.523
2	12.567	4.188
3	28.274	14.137
4	50.265	33.51
5	78.540	65.45
10	314.159	523.6
15	706.9	1767.1
20	1256.6	4189.
25	1963.5	8181.
30	2827.	14137.
40	5026.	33510.

6003. To Find the Cubical Contents of Spars or Other Round Timber. If the spar or timber were the same thickness through its entire length, the diameter of all parts would be the same, and one measurement would suffice to obtain the correct diameter; its cubical contents could then be found in the same way as for a cylinder; but this is hardly ever the case, as the thickness or diameter is different in every part. If the spar tapers regularly from one end to the other, measure the diameter at each end, add the two measurements together, and divide their sum by 2; this will give the *average* diameter. A piece of timber of irregular thickness must be measured in portions, each portion extending as far as the tapering is regular, and the contents of the different portions added together to get the contents of the whole. Having obtained the correct diameter in inches, look for it in the next table, and opposite it, in the next column to the right, will be the contents in feet of 1 foot of timber in length; multiply this by the length of the timber in feet, and the result will be the contents of the whole.

Thus, to find the contents of a 16-foot log whose average diameter is found to be 13½ (that is, 13.5) inches, we find the figures on the next right hand column in the table are .99; this means that a log 1 foot long and 13½ inches in diameter contains .99 or $\frac{99}{100}$ of a cubic foot. Multiply this .99 by 16, the length of the log in feet, and we get 15.84, or about 15⅞ cubic feet, which is the contents of the whole log.

About 10 per cent. should be deducted from the results given in the table when toll is charged on rafts of spars or logs, for the reason that many sticks of timber taper suddenly, and others are unequal in diameter when the average is taken.

Diameter Inches.	Contents. 1 foot long.	Diameter Inches.	Contents. 1 foot long.
4.	.0872	27.5	4.12
5.	.137	28.	4.28
6.	.196	28.5	4.43
7.	.267	29	4.59
7.5	.31	29.5	4.75
8.	.35	30.	4.91
8.5	.39	30.5	5.07
9.	.44	31.	5.24
9.5	.49	31.5	5.41
10.	.55	32.	5.58
10.5	.60	32.5	5.76
11.	.66	33.	5.94
11.5	.72	33.5	6.12
12.	.79	34.	6.31
12.5	.85	34.5	6.49
13.	.92	35.	6.68
13.5	.99	35.5	6.87
14.	1.07	36.	7.07
14.5	1.15	36.5	7.27
15.	1.23	37.	7.47
15.5	1.31	37.5	7.67
16.	1.40	38.	7.88
16.5	1.48	38.5	8.09
17.	1.58	39.	8.30
17.5	1.67	39.5	8.51
18.	1.77	40.	8.73
18.5	1.87	40.5	8.95
19.	1.97	41.	9.17
19.5	2.07	42.	9.61
20.	2.18	43.	10.08
20.5	2.29	44.	10.555
21.	2.40	45.	11.044
21.5	2.52	46.	11.541
22.	2.64	47.	12.049
22.5	2.76	48.	12.566
23.	2.89	49.	13.095
23.5	3.11	50.	13.635
24.	3.14	51.	14.186
24.5	3.27	52.	14.747
25.	3.41	53.	15.320
25.5	3.55	54.	15.904
26.	3.69	55.	16.499
26.5	3.83	56.	17.104
27.	3.98	57.	17.720

6004. Capacity of Cubical Boxes. A box 1 foot and 1 inch each way, *i. e.*, length, breadth, and depth, will contain 1 standard bushel.

Feet.	Inches.		Bushels.
1	1	=	1
1	4½	=	2
1	6¾	=	3
1	8½	=	4
1	10$\frac{1}{16}$	=	5
1	11½	=	6
2	¾	=	7
2	2	=	8
2	3	=	9
2	4	=	10

6005. Capacity of Boxes of Different Dimensions. A box 4 feet 7 inches long, and 2 feet 4 inches in width, and 2 feet 4 inches in depth, will contain 20 bushels. The dimensions of a cylinder containing 1 United States standard bushel are 18½ inches inside diameter, and 8 inches deep. A box 24 inches by 16 inches square, and 28 inches deep, will contain a barrel, 5 bushels. A box 24 inches by 16 inches square, and 14 inches deep, will contain a half barrel. A box 24 inches by 11.2 inches square, and 8 inches deep, will contain 1 bushel. A box 12 inches by 11.2 inches square, and 8 inches deep, will contain ½ bushel. A box 8 inches by 8.4 inches square, and 8 inches deep, will contain 1 peck. A box 8 inches by 8 inches square, and 4.2 inches deep, will contain 1 gallon. A box 7 inches by 8 inches square, and 4.8 inches deep, will contain 1 gallon. A box 4 inches by 4 inches square, and 4.2 inches deep, will contain 1 quart.

6006. To Find the Amount of Lumber any Log will Make. Find the length of the log in the left-hand column of the next Table; then on the top of the page find the diameter, and under the same will be found the quantity of lumber the log will make; calculated for any length from 10 to 25 feet, and for any diameter from 12 to 44 inches.

Table Showing the Number of Feet of Inch-Board in a Log of Timber.

Length in Feet	Diameter in Inches.																
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
10	49	61	72	89	99	116	133	150	175	190	209	235	252	287	313	342	363
11	54	67	79	98	109	127	147	165	192	209	230	259	278	315	344	377	400
12	59	73	86	107	119	139	160	180	210	228	251	283	303	344	375	411	436
13	64	79	93	116	129	150	173	195	227	247	272	306	328	373	408	445	473
14	69	85	100	125	139	162	187	210	245	266	292	330	353	401	439	479	509
15	74	91	107	134	149	173	200	225	262	285	313	353	379	430	469	514	545
16	79	97	114	142	159	185	213	240	280	304	334	377	404	459	500	548	582
17	84	103	122	151	168	196	227	255	297	323	355	400	429	487	531	582	618
18	89	109	129	160	178	208	240	270	315	342	376	424	454	516	562	616	654
19	93	116	136	169	188	219	253	285	332	361	397	447	480	545	594	650	692
20	98	122	143	178	198	232	267	300	350	380	418	470	505	573	625	684	728
21	103	128	150	187	208	243	280	315	368	399	439	495	530	603	656	719	764
22	108	134	157	196	218	255	293	330	385	418	460	518	555	631	688	753	800
23	113	140	164	205	228	266	307	345	403	437	480	542	571	659	719	787	837
24	118	146	172	214	238	278	320	360	420	456	501	566	606	688	750	821	873
25	123	152	179	223	248	289	333	375	438	475	522	589	631	717	781	856	910

Length in Feet	Diameter in Inches.															
	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
10	381	411	444	460	490	500	547	577	644	669	700	752	795	840	872	925
11	419	451	488	506	539	550	602	634	708	734	770	828	874	924	959	1017
12	457	493	532	552	588	600	657	692	772	801	840	903	954	1007	1046	1110
13	495	534	576	598	637	650	712	750	836	868	910	978	1033	1091	1135	1203
14	533	575	622	644	686	700	766	807	901	934	980	1053	1113	1175	1222	1295
15	571	616	666	690	735	750	821	865	965	1001	1050	1129	1192	1259	1309	1388
16	609	657	710	736	784	800	876	923	1029	1068	1120	1204	1272	1343	1396	1480
17	647	698	755	782	833	850	931	980	1094	1134	1190	1279	1351	1427	1484	1573
18	685	739	799	828	882	900	985	1038	1158	1201	1260	1354	1431	1511	1571	1665
19	723	780	843	874	931	950	1040	1096	1222	1268	1330	1430	1510	1595	1658	1758
20	761	821	888	920	980	1000	1095	1152	1287	1335	1400	1505	1590	1679	1745	1850
21	800	863	932	966	1029	1050	1150	1210	1351	1401	1470	1580	1669	1763	1833	1943
22	838	904	976	1012	1078	1100	1204	1268	1415	1468	1540	1655	1749	1847	1920	2035
23	876	945	1021	1058	1127	1150	1259	1322	1480	1535	1610	1730	1828	1931	2007	2128
24	914	986	1065	1104	1176	1200	1314	1380	1544	1601	1680	1806	1908	2015	2094	2220
25	952	1027	1109	1150	1225	1250	1369	1438	1608	1668	1750	1881	1987	2099	2182	2313

6007. Measure of Time.

Lunar Month.	Weeks.	Days.	Hours.	Minutes.	Seconds.
1 =	4 =	28 =	672 =	40,320 =	2419,200
	1 =	7 =	168 =	10,080 =	604,800
		1 =	24 =	1,440 =	86,400
			1 =	60 =	3,600
				1 =	60

The year of 365 days is divided into 12 calendar months, 7 of which have 31 days; 4 have 30 days; and 1, February, 28 days. The solar year consists of 365 days, 5 hours, 48 minutes, and 49 seconds; this excess over 365 days, nearly 6 hours, or ¼ day, is allowed to accumulate through each 4 years, and provided for every fourth, or leap year, by adding 1 day to February; but as this is adding a trifle too much, every 400 years one leap year is omitted, and this occurs when the year is divisible by 400 without remainder.

In the year 1582, the fact was observed by Pope Gregory XIII that, in consequence of this discrepancy not having been taken into account since the commencement of the Julian system (*see No.* 6064), the true time exceeded the time as then reckoned by 10 days; and therefore ordered the 11th of March to be accounted the 21st. The Pope's edict was generally observed by the nations subject to his authority, but the Protestant countries continued the use of the Julian reckoning. This gave rise to the two modes of computation still found in Europe, called the old style and new style. The latter was adopted in England in 1752, by making the 1st of September the 12th.

Whenever the date of the year is divisible by 4 without remainder, February has 29 days, and that year is called Bissextile.

6008. Table Showing the Number of Days from any Date in One Month to the Same Date in any Other Month.

From To	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
January.	365	31	59	90	120	151	181	212	243	273	304	334
Feby....	334	365	28	59	89	120	150	181	212	242	273	303
March...	306	337	365	31	61	92	122	153	184	214	245	275
April.....	275	306	334	365	30	61	91	122	153	183	214	244
May.....	245	276	304	335	365	31	61	92	123	153	184	214
June....	214	245	273	304	334	365	30	61	92	122	153	183
July.....	184	215	243	274	304	335	365	31	62	92	123	153
August..	153	184	212	243	273	304	334	365	31	61	92	122
Sept.....	122	153	181	212	242	273	303	334	365	30	61	91
October.	92	123	151	182	212	243	273	304	335	365	31	61
Nov.....	61	92	120	151	181	212	242	273	304	334	365	30
Dec......	31	62	90	121	151	182	212	243	274	304	335	365

Example: How many days from the 2d of February to the 2d of August? Look for February at the left hand, and August at the top, in the angle is 181. In leap year, add one day if February be included.

6009. Table Showing Difference of Time at 12 o'Clock (Noon) at New York.

New York......	12.00 N.	Boston.........	12.12 P. M.
Buffalo..........	11.40 A. M.	Quebec.........	12.12 "
Cincinnati......	11.18 "	Portland........	12.15 "
Chicago.........	11.07 "	London........	4.55 "
St. Louis.......	10.55 "	Paris...........	5.05 "
San Francisco..	8.45 "	Rome..........	5.45 "
New Orleans...	10.56 "	Constantinople.	6.41 "
Washington....	11.48 "	Vienna.........	6.00 "
Charleston.....	11.36 "	St. Petersburg..	6.57 "
Havana........	11.25 "	Pekin, night...	12.40 A. M.

6010. Geographical or Nautical Measure.

Great Circle.		Degrees.		Leagues.		Geo. Miles.
1	=	360	=	7200	=	21600
		1	=	20	=	60
				1	=	3

The geographical or nautical mile, according to Brande, is equivalent to 1.153 statute miles; this would give 2029.3 yards to the nautical mile, 69.18 statute miles to the degree, and about 24.905 miles for the earth's equatorial circumference. According to one of the very best authorities, Chambers' Encyclopædia, the nautical mile contains 2029 yards; on this basis, a degree would measure about 69.17 statute miles, and the earth's circumference about 24.901 statute miles. A great circle of the earth is an imaginary line or belt so drawn round the earth as to divide it into two equal parts or hemispheres; the equator and the ecliptic are great circles. In navigation, sailors measure depth of soundings and short distances by the *fathom* of 6 feet, and the *cable-length* of 120 fathoms.

6011. Nautical Time. The hour of the day or night is noted on board a ship by 1, 2, 3, &c., up to 8 bells. The 12 hours between midnight and noon, or noon and midnight, are divided into 3 portions of 8 bells each, the duration of time between bells being half an hour. During the course of each 12 hours, the same number of strokes of the bell will necessarily be used to denote three different hours or periods of time.

Bell.		Clock-Time.	Clock-Time.	Clock-Time.
1	denotes	12.30	4.30	8.30
2	"	1.	5.	9.
3	"	1.30	5.30	9.30
4	"	2.	6.	10.
5	"	2.30	6.30	10.30
6	"	3.	7.	11.
7	"	3.30	7.30	11.30
8	"	4.	8.	12.

6012. Capacity of Cisterns, &c.

Diameter in Feet and Inches.	Depth in Feet and Inches.	Number of Wine Gallons.	Number of Barrels.	No. of Hhds.	No. of Gallons in 10 Inches Depth.
2 ft.	2 ft.	45	$1\frac{9}{21}$	$\frac{45}{63}$	19
2 ft. 6 in.	2 ft. 6 in.	90	$2\frac{6}{7}$	$1\frac{6}{14}$	30
3 ft.	3 ft.	158	5	$2\frac{1}{2}$	44
3 ft. 6 in.	3 ft. 6 in.	252	8	4	60
4 ft.	4 ft.	374	$11\frac{55}{63}$	$5\frac{59}{63}$	78
4 ft. 6 in.	4 ft. 6 in.	524	$16\frac{40}{63}$	$8\frac{20}{63}$	97
5 ft.	5 ft.	732	$23\frac{15}{63}$	$11\frac{39}{63}$	122
5 ft. 6 in.	5 ft. 6 in.	976	31	$15\frac{1}{2}$	148
6 ft.	6 ft.	1267	$40\frac{2}{9}$	$20\frac{1}{9}$	176
6 ft. 6 in.	6 ft. 6 in.	1614	$51\frac{15}{63}$	$25\frac{39}{63}$	207
7 ft.	7 ft.	2016	64	32	240
8 ft.	8 ft.	3004	$95\frac{23}{63}$	$47\frac{43}{63}$	313
8 ft. 6 in.	8 ft. 6 in.	3600	$114\frac{18}{63}$	$57\frac{9}{63}$	353
9 ft.	9 ft.	4276	$135\frac{47}{63}$	$67\frac{55}{63}$	396
9 ft. 6 in.	9 ft. 6 in.	5027	$159\frac{37}{63}$	$79\frac{50}{63}$	441
10 ft.	10 ft.	5868	$186\frac{18}{63}$	$93\frac{9}{63}$	489
11 ft.	11 ft.	7814	$248\frac{4}{63}$	$124\frac{2}{63}$	592
12 ft.	12 ft.	10152	$322\frac{18}{63}$	$161\frac{9}{63}$	705
13 ft.	13 ft.	12901	$409\frac{5}{9}$	$204\frac{49}{63}$	827
14 ft.	14 ft.	16111	$511\frac{29}{63}$	$255\frac{46}{63}$	959
15 ft.	15 ft.	19818	$629\frac{8}{63}$	$314\frac{36}{63}$	1101
20 ft.	20 ft.	46992	$1491\frac{51}{63}$	$745\frac{57}{63}$	1958
25 ft.	25 ft.	91770	$2913\frac{1}{8}$	$1456\frac{2}{3}$	3059

Example: Suppose you desire to ascertain the capacity of a cistern 4 feet 6 inches in diameter and 4 feet 6 inches in depth. Find the diameter in the left hand column, and directly opposite you will see that the cistern will hold 524 gallons of 231 cubic inches each, equal to $16\frac{40}{63}$ barrels, or $8\frac{20}{63}$ hogsheads.

The right hand column shows the number of gallons contained in 10 inches of depth. By this standard you may easily increase or diminish the capacity at pleasure. Thus, if you wish the above cistern to hold 97 gallons more, make it 10 inches deeper; or 194 gallons more, 20 inches deeper.

6013. Log Lines. 1 knot = 51.1625 feet, or 51 feet $1\frac{3}{4}$ + inches. 1 fathom = 5.11625 feet, or 5 feet $1\frac{1}{8}$ + inches, estimating a mile at $6139\frac{1}{2}$ feet, and using a 30″ glass. If a 28″ glass is used, and eight divisions, then 1 knot = 47 feet 9 + inches. 1 fathom = 5 feet $11\frac{5}{8}$ inches. The line should be about 150 fathoms long, having 10 fathoms between the chip and first knot for stray line. Miles × .87 = knots. Knots × 1.15 = miles. Feet per minute × .01 = knots per hour. 1 knot = 6082.66 feet; 1 statute mile = 5280 feet.

6014. The Decimal System of Weights and Measures. A permissive law has already been passed by the American and British governments, adopting the decimal system as applied to weights and measures. It is substantially the same as the French decimal system, and founded on units of the same value. The multiples and subdivisions of the different units are the same; Greek prefixes being used to denote the multiples, and Latin prefixes the fractional parts of the units.

The Greek prefix	DEKA	means	10	units
" "	HECTO	"	100	"
" "	KILO	"	1000	"
" "	MYRIA	"	10000	"
The Latin prefix	DECI	"	$\frac{1}{10}$	of a unit
" "	CENTI	"	$\frac{1}{100}$	"
" "	MILLI	"	$\frac{1}{1000}$	"

The fundamental unit of all the decimal weights and measures is the METRE; the standard length of which is the $\frac{1}{10000000}$ of a quadrant of the earth's meridian, equivalent to 39.371 inches. The unit of dry and liquid measures of capacity is the LITRE, which is the $\frac{1}{1000}$ of a cubic metre, and contains 61.028 cubic inches. These figures are as exact as a calculation involving twelve places of decimals will bring it. The government standard, adopted as sufficiently correct for all practical purposes, is 61.022 cubic inches; this is based on a metre of 39.3685 inches, which would make the gram 15.432 grains. The GRAM or unit of weight is the weight of a cubic centimetre ($\frac{1}{100}$ of a metre) of water at 39.83° Fahr., and is equivalent to 15.434 grains. For post-office purposes, the $\frac{1}{2}$ ounce avoirdupois is declared equivalent to 15 grams. The ARE, or unit of surface measurement, is the $\frac{1}{100}$ of a square metre, or 119.6 square yards. This system of weights and measures has not as yet come into general use, either in America or England. Its advantages are indisputably great for facilitating calculation as well as establishing uniform international standards; but its adoption necessarily meets with much opposition, as it overthrows not only all the old, arbitrary units of measurement, but their multiples and subdivisions also. It seems so natural to halve and quarter, and count by the dozen, that even in our decimal currency we cannot dispense with the half and quarter dollar and eagle; in fact, the advantage of our decimal currency cannot be appreciated to its full extent until the custom of counting by the dozen is entirely superseded by the decade. The dozen, 12, is divisible by 2, 3, 4, and 6; the decade, 10, by 2 and 5 only; and, although this is a matter of little moment as far as regards calculation, it makes a great difference for practical subdivision. Old rooted customs are difficult to eradicate, but there is no doubt that the dozen, half, and quarter, those stumbling-blocks in the way of the decimal system, will eventually disappear as entirely as the now totally obsolete eighth and sixteenth of a dollar, the Mexican shilling and sixpence.

6015. Official Standard Metre. The following information was lately given by Mr. Hilgard, of the United States Coast Survey, to the Journal of the Franklin Institute: "There are, in the custody of the Treasury Department, at the Office of Weights and Measures, the following authentic copies of the standard metre and kilogramme of France, viz.: Metre of platinum, compared and certified by Arago; metre of steel, compared and certified by Silbermann; kilogramme of platinum, compared and certified by Arago; kilogramme of brass (gilt), compared and certified by Silbermann. The length of the metre is 39.3685 inches of the United States standard scale, and the kilogramme is 15432.2 grains, or 2 pounds, 3 ounces, 119.7 grains avoirdupois. There is also another metre, the property of the American Philosophical Society, which is one of the twelve original metres made by the French Government, and was brought to this country by Mr. Hassler, the originator of the United States Coast Survey. A comparison between this bar and the standard of France at the Conservatory of Arts and Trades was made by Dr. F. A. P. Barnard, with the result that, at the temperature of melting ice, there is no appreciable difference, by the most delicate means of comparison, between the platinum standard of the Conservatory and this iron metre."

The above standard metre of 39.3685 inches would make the equatorial circumference of the earth measure 24.854 statute miles. Bessel's calculations, given in Chambers' Encyclopædia, give the equatorial circumference at $24.901\frac{4}{11}$ miles. If this measurement be correct, the standard metre should be 39.371 inches. This difference, however, is so trifling that it would not be appreciable for all practical purposes.

6016. Decimal Measures of Length.

Myriametre	=	10,000	metres.
Kilometre	=	1,000	metres.
Hectometre	=	100	metres.
Dekametre	=	10	metres.
Metre	=	1	metre.
Decimetre	=	$\frac{1}{10}$	metre.
Centimetre	=	$\frac{1}{100}$	metre.
Millimetre	=	$\frac{1}{1000}$	metre.

6017. Value of Metric Measures of Length in Long Measure.

		Miles.	Yds.	Ft.	Inches.
Myriametre	=	6	376	1	2
Kilometre	=		1093	1	11
Hectometre	=		109	1	1.1
Dekametre	=		10	2	9.71
Metre	=		1	0	3.371
Decimetre	=				3.937
Centimetre	=				.394

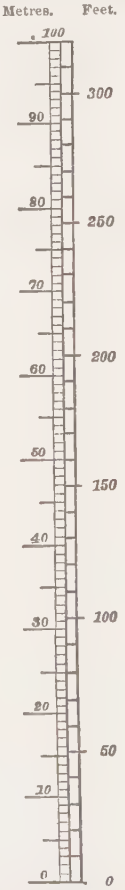
For general purposes, or small calculations, the following equivalents will be found sufficiently accurate: 1 millimetre is equal to $\frac{1}{25}$ inch; 1 centimetre is equal to $\frac{2}{5}$ inch; 1 decimetre is equal to $3\frac{9}{10}$ inches; 1 metre is equal to $39\frac{1}{8}$ inches; $\frac{91}{100}$ metre is equal to 36 inches or 1 yard.

6018. Value of Metres in Inches.

Millimetre.		Metre.		Inches.
1	=	.001	=	.03937
2	=	.002	=	.07874
3	=	.003	=	.11811
4	=	.004	=	.15748
5	=	.005	=	.19685
6	=	.006	=	.23622
7	=	.007	=	.27560
8	=	.008	=	.31497
9	=	.009	=	.35434
Centimetre.				
1	=	.01	=	.3937
2	=	.02	=	.7874
3	=	.03	=	1.1811
4	=	.04	=	1.5748
5	=	.05	=	1.9685
6	=	.06	=	2.3622
7	=	.07	=	2.7559
8	=	.08	=	3.1497
9	=	.09	=	3.5434
Decimetre.				
1	=	.1	=	3.9371
2	=	.2	=	7.8742
3	=	.3	=	11.8113
4	=	.4	=	15.7484
5	=	.5	=	19.6855
6	=	.6	=	23.6226
7	=	.7	=	27.5597
8	=	.8	=	31.4968
9	=	.9	=	35.4339

6019. Value of Metres in Feet.

Decimetres.				Feet.
1	=			.328
2	=			.656
3	=			.984
4	=			1.312
5	=			1.640
6	=			1.968
7	=			2.297
8	=			2.625
9	=			2.953
Metres.				
1	=			3.281
2	=			6.562
3	=			9.843
4	=			13.124
5	=			16.405
6	=			19.686
7	=			22.967
8	=			26.248
9	=			29.529
Dekametre.		Metres.		
1	=	10	=	32.81
2	=	20	=	65.62
3	=	30	=	98.43
4	=	40	=	131.24
5	=	50	=	164.05
6	=	60	=	196.86
7	=	70	=	229.67
8	=	80	=	262.48
9	=	90	=	295.29
Hectometre.				
1	=	100	=	328.1
2	=	200	=	656.2
3	=	300	=	984.3
4	=	400	=	1312.4
5	=	500	=	1640.5
6	=	600	=	1968.6
7	=	700	=	2296.7
8	=	800	=	2624.8
9	=	900	=	2952.9



The foregoing scale may be used for any other portion of the metrical system; for instance, if millimetres be used instead of decimetres, the relative scale of feet will consist of the same figures, with the decimal point removed one place to the left, to divide by 10, the millimetre being $\frac{1}{10}$ decimetre.

6020. Decimal Measures of Capacity.

Names.	Number of Litres.	Cubic Measure.
Kilolitre, or stere	1,000	1 cubic metre
Hectolitre........	100	$\frac{1}{10}$ cubic metre
Dekalitre........	10	10 cu. decimetres
Litre............	1	1 cub. "
Decilitre........	$\frac{1}{10}$	$\frac{1}{10}$ cub. "
Centilitre.......	$\frac{1}{100}$	10 cu. centimetre
Millilitre........	$\frac{1}{1000}$	1 cu. centimetre

The following are approximate values, correct enough for rough calculations. One millilitre is equal to 15½ grain measures of water; one centilitre is equal to 154 grain measures, or 3 fluid drachms; one decilitre is equal to 1,540 grain measures, or 3½ fluid ounces; one litre is equal to 15,406 grain measures, or 2$\frac{1}{10}$ pints; one cubic centimetre of water at its maximum density weighs 15½ grains, and is $\frac{2}{7}$ fluid drachm.

6021. Value of Metric Measures of Capacity in U. S. Dry Measure.

		Bush.	Peck.	Quart.	Pint.
Kilolitre	=	28	1	4$\frac{1}{7}$	
Hectolitre	=	2	3	2	1.6
Dekalitre	=		1	0	1.6
Litre	=				1.816
Decilitre	=				.181
Centilitre	=				.018

6022. Value of Metric Measures of Capacity in U. S. Liquid Measure.

		Gals.	Quarts.	Pints.	Gills.
Kilolitre	=	264	0	1	1.6
Hectolitre	=	26	1	1	1.36
Dekalitre	=	2	2	1	0.136
Litre	=		1	0	0.413
Decilitre	=				.841
Centilitre	=				.084

6023. Equivalent of Metric Measures of Capacity in U. S. Apothecaries Measure.

		Gal.	Pint.	Fluid Ounce.	Fluid Drachm.	Minims.
Hectolitre	=	26	3	5	5	20
Dekalitre	=	2	5	2	1	20
Litre	=		2	1	6	32
Decilitre	=			3	3	3
Centilitre	=				2	42

6024. Value of Metric Measures of Capacity in Imperial Dry Measure.

		Bush.	Pecks.	Gals.	Pints.
Kilolitre	=	27	2	0	0.800
Hectolitre	=	2	3	0	0.080
Dekalitre	=			2	1.608
Litre	=				1.760
Decilitre	=				.176

6025. Value of Metric Measures of Capacity in Imperial Liquid Measure.

		Hhds.	Gals.	Qts.	Pts.	Gills.
Kilolitre	=	3	31	0	0	3.200
Hectolitre	=		22	0	0	0.320
Dekalitre	=		2	0	1	2.432
Litre	=				1	3.040
Decilitre	=					.704

6026. Decimal Measures of Surface.

		Equivalents in Square Measure.		
		Acres.	Sq. yds.	Sq. ft.
Hectare..	10,000 square metres	2	2279	5.76
Are......	100 square metres		119	5.4
Centare...	1 square metre		1	1.76

6027. Decimal Weights.

Names	Number of Grams.	Weight of what quantity of Water at maximum density.
Millier, or Tonneau	1,000,000	1 cub. metre
Quintal..........	100,000	1 hectolitre
Myriagram........	10,000	10 litres
Kilogram or kilo..	1,000	1 litre
Hectogram.......	100	1 decilitre
Dekagram........	10	10 cu. cent're
Gram.............	1	1 cu. cent're
Decigram.........	$\frac{1}{10}$	$\frac{1}{10}$ cu. cent're
Centigram........	$\frac{1}{100}$	10 cu. milm's
Milligram.........	$\frac{1}{1000}$	1 cu. milm'e

6028. Equivalent of Metric Weights in Avoirdupois Weight.

		Lbs.	Oz.	Dr.
Millier	=	2204	9	1.6
Quintal	=	220	7	4.96
Myriagram	=	22	0	11.69
Kilogram	=	2	3	4.37
Hectogram	=		3	8.44
Dekagram	=			5.64
Gram	=			.56

6029. Equivalent of Metric Weights in Troy Weight.

		Lbs.	Oz.	Dwts.	Grains.
Millier	=	2677	1	19	20.
Quintal	=	267	8	11	23.6
Myriagram	=	26	9	5	4.77
Kilogram	=	2	8	2	12.48
Hectogram	=		3	4	6.05
Dekagram	=			6	10.21
Gram	=				15.43
Decigram	=				1.54
Centigram	=				.15

6030. Equivalent of Metric Weights in U. S. Apothecaries Weight.

		Lbs.	Oz.	Dr.	Scr.	Grs.
Millier	=	2677	1	7	2	16.
Quintal	=	267	8	4	2	7.6
Myriagram	=	26	9	2	0	4.77
Kilogram	=	2	8	1	0	0.48
Hectogram	=		3	1	2	2.05
Dekagram	=			2	1	14.21
Gram	=					15.43
Decigram	=					1.54

For general purposes the following values are sufficiently correct: 1 milligram is equal to $\frac{1}{64}$ grain; 1 centigram is equal to $\frac{1}{6}$ grain; 1 decigram is equal to $1\frac{1}{2}$ grains; 1 gram is equal to $15\frac{1}{2}$ grains; 1 dekagram is equal to 154 grains; 1 hectogram is equal to 1,543 grains; 1 kilogram is equal to 15,432 grains.

6031. English Weights and Measures. Avoirdupois and Troy weight are exactly the same as used in the United States, and the tables will be found in Nos. 5935, &c. In the new British Pharmacopœia, the weights are expressed in pounds, ounces, and grains, avoirdupois; thus superseding the Apothecaries weight as now in use in the United States. The old British avoirdupois drachm ($\frac{1}{16}$ ounce or 27.344 grains) is now obsolete, except in weighing silk. The new drachm is $\frac{1}{8}$ ounce.

6032. Imperial Standard Measure.

Gal.	Quarts.	Pints.	F. Oz.	F. Dr.	Minims.
1 =	4 =	8 =	160 =	1280 =	76.800
	1 =	2 =	40 =	320 =	19.200
		1 =	20 =	160 =	9.600
			1 =	8 =	480
				1 =	60

The standard unit of this measure is the gallon which is declared by statute to contain 10 pounds avoirdupois (70,000 Troy grains) of distilled water at a temperature of 62° Fahr., the barometer being at 30 inches. The weight of a cubic inch of water, under the foregoing conditions, is 252.458 grains; the capacities of the measures are therefore as follows:

Imperial Gallon = 277.274 Cubic Inches.
" Quart = 69.3185 "
" Pint = 34.65925 "
Fluid Ounce = 1.73296 "
" Drachm = .21662 "

Thus it will be seen that there is a slight difference in weight between the English and United States unit of capacity, viz.: The cubic inch of water; the English being weighed at 62° Fahr., and the United States at 39.83°. (*See No.* 5935.)

6033. Imperial Measure Expressed in Litres.

1 Gallon = 4.54339 Litres
1 Quart = 1.13585 "
1 Pint = 5.67925 Decilitres
1 Fluid Ounce = 2.83962 Centilitres
1 " Drachm = 3.54952 Millilitres
1 Minim = .05916 "

6034. Measure of Capacity for all Liquids.

Tun.	Pipes.	Hhds.	Bbls.	Gallons.	Quarts.	Pints.	Gills.
1 =	2 =	4 =	8 =	252 =	1008 =	2016 =	8064
	1 =	2 =	4 =	126 =	504 =	1008 =	4032
		1 =	2 =	63 =	252 =	504 =	2016
			1 =	31½ =	126 =	252 =	1008
				1 =	4 =	8 =	32
					1 =	2 =	8
						1 =	4

The gallon is the Imperial measure of 277.274 cubic inches; and the gill contains 5 ounces avoirdupois of water. In addition to the above measures, there is the Tierce of 42 gallons, and the Puncheon of 84 gallons.

6035. Comparative Value of Imperial Measure and U. S. Liquid Measure.

Imperial.	United States.		Gall.	Qt.	Pints.	Gills.
1 Gallon	= 1.20032 Gallons,	or	1	0	1	2.41
1 Quart	= 1.20032 Quarts,	or		1	0	1.60
1 Pint	= 1.20032 Pints,	or			1	0.80
1 Gill	= 1.20032 Gills,	or				1.20

6036. Imperial Liquid Measure Expressed in Litres.

1 Hogshead = 2.86234 Hectolitres
1 Barrel = 1.43117 "
1 Gallon = 4.54339 Litres
1 Quart = 1.13585 "
1 Pint = 5.67925 Decilitres
1 Gill = 1.41981 "

6037. Dry or Corn Measure.

Quarter.	Bushels.	Pecks.	Gallons.	Pints.	Capacity in Cubic Inches.
1 =	8 =	32 =	64 =	512 =	17,745.536
	1 =	4 =	8 =	64 =	2,218.192
		1 =	2 =	16 =	554.548
			1 =	8 =	277.274
				1 =	34.659

The above capacities are for *struck* measure; the heaped measures contain nearly $\frac{1}{8}$ more, the heaped bushel containing $2815\frac{1}{2}$ cubic inches.

6038. Relative Value of Imperial Dry Measure and United States Dry Measure.

Imperial.	United States.		Qr.	Bush.	Pecks.	Qts.	Pints.
1 Quarter	= 1.03151 Quarters,	or	1	0	1	0	0.133
1 Bushel	= 1.03151 Bushels,	or		1	0	1	0.016
1 Peck	= 1.03151 Pecks,	or			1	0	0.404
1 Gallon	= 4.12604 Quarts,	or				4	0.252
1 Pint	= 1.03151 Pint,	or					1.031

6039. Relative Value of Imperial Measure and United States Standard Apothecaries Measure.

				Gal.	Pint.	Fl. Oz.	Fl. Dr.	Minims.
1 Imp. Gallon	= 1.20032	U. S. Gallons,	or	1	1	9	5	7.66
1 " Pint	= 1.20032	" Pints,	or		1	3	1	38.45
1 " Fluid Ounce	= .960256	" Fluid Ounces,	or				7	40.92
1 " Fluid Drachm	= .960256	" Fluid Drachms,	or					57.62
1 " Minim	= .960256	" Minims,	or					.96

6040. Imperial Dry Measure Expressed in Litres.

1 Quarter = 2.90777 Hectolitres
1 Bushel = 3.63471 Dekalitres
1 Peck = 9.08677 Litres
1 Gallon = 4.54338 "
1 Pint = 5.67922 Decilitres

6041. The English Last is an English measure of various articles. A last of soap, ashes, herrings, and some other articles, is 2 barrels. A last of corn is 10 quarters. A last of gun-powder, 24 barrels. A last of flax or feathers, 1,700 pounds. A last of wool, 12 sacks.

6042. The Scotch Pint. A Scotch pint contains 105 cubic inches, and is equal to 4 English pints. 21¼ Scotch pints make a farlot of wheat.

6043. English Wood Measures. Wood is sold in England by the stack, skid, quintal, billet, and bundle. A stack is 108 solid feet, and usually piled 12 feet long, 3 feet high, and 3 feet wide. A quintal of wood is 100 lbs. A skid is a round bundle of sticks, 4 feet long. A one-notch skid girts 16 inches. A two-notch skid, 23 inches. A three-notch skid, 28 inches. A four-notch skid, 33 inches. A five-notch skid, 38 inches. A billet of wood is a bundle of sticks 3 feet long, and girts 7, 10, or 14 inches, and these bundles sell by the score or hundred. A score is 20, and comes from the count by tally, or marks. Faggots of wood are bundles of brush, 3 feet long, 2 feet round. A load of faggots is 50 bundles.

6044. English Coinage. English money is reckoned in pounds, shillings, pence and farthings thus symboled and relatively valued.

£		*s.*		*d.*		*q.*
1	=	20	=	240	=	960
		1	=	12	=	48
				1	=	4

The farthing, or fourth part of a penny, is always written in the form of the fraction of a penny, one farthing being ¼ penny, 2 farthings ½ penny, &c. The standard sovereign is made of 22 carats pure gold and 2 carats copper alloy. The coin weighs 123.274 Troy grains; and the standard value of gold is £3, 17, 10½ ⅌ Troy ounce, or £46, 14, 6 ⅌ Troy pound. The half-sovereign, or 10 shilling gold coin is of the same standard, and half the weight and value of the sovereign. The standard shilling is composed of 222 parts pure silver alloyed with 18 parts copper. The coin weighs 87 3/11 Troy grains; and the standard value is £3, 6, 0 ⅌ pound troy; consequently 66 shillings weigh exactly 1 pound Troy. The crown, or 5 shilling piece, the half-crown, value 2s, 6d, and the six pence, are of the same standard and relative weights.

6045. French Weights and Measures. There are two systems of weights in use in France; the système usuel, or old Binary and the more modern Decimal system. The former is still the most used in buying and selling, but the decimal system is already employed for all scientific purposes.

6046. French Binary Weights. These are more or less in common use in France, but are gradually being superseded by the decimal system.

Kilogram.		Livre.		Once.		Gros.		Denier.		French Grains.
1	=	2	=	32	=	256	=	768	=	18,432
		1	=	16	=	128	=	384	=	9,216
				1	=	8	=	24	=	576
						1	=	3	=	72
								1	=	24

6047. French Binary Weights Compared with Avoirdupois Weight. French Apothecaries weight is the same as the above, except that the livre contains 12 instead of 16 onces. The old French grain was equivalent to .820 of a Troy grain, but the new French grain (of 1812) is equal to .8365228 grains Troy. This would make the French Binary weight, as compared with Avoirdupois weight.

		Avoirdupois.
1 French Grain	=	.8365 Grains
1 " Denier	=	20.0765 "
1 " Gros	=	60.2296 "
1 " Once	=	1.1023 Ounces
1 " Livre	=	1.1023 Pounds
1 " Kilogramme	=	2.2046 "

6048. French Binary Weights Compared with U. S. Apothecaries Weight.

	Lbs.	Oz.	Drms.	Scruples.	Grains.
1 French Livre (16 oz) =	1	4	0	1	9.3941
1 " " (12 oz) =	1	0	0	1	2.0456
1 " Once =		1	0	0	1.8371
1 " Gros =			1	0	0.2296
1 " Denier =				1	0.0765
1 " Grain =					.8365

6049. Value of French Binary Weights in Troy Weight.

	Lb.	Oz.	Dwt.	Gr.
1 French Livre (16 oz.) =	1	4	1	5.184
1 " " (12 oz.) =	1	0	0	21.888
1 " Once =		1	0	1.824
1 " Gros =			2	12.228
1 " Denier =				20.076
1 " Grain =				.8365

6050. Value of French Binary Weights in Grams.

1 French Livre (16 oz.) = 4.9957 Hectograms
1 " " (12 oz.) = 3.7468 "
1 " Once = 3.1223 Dekagrams
1 " Gros = 3.9028 Grams.
1 " Denier = 1.3009 "
1 " Grain = .0542 "

6051. Old French Linear Measure. The former measures of length in France were the

Toise = 1.949 metres, or 6.3945 feet
Foot (pied) = .32484 " = 12.785 inches
Inch (pouce) = .02707 " = 1.0654 "
Line (ligne) or 1/12 inch = .002256 metre

The metre is equal to 3 ft. 11 lines old French measure.

6052. French Decimal Weights and Measures. The French Gramme, litre, metre and are, are precisely the same as in the American Decimal system. They are founded on the same standard unit, the metre; and therefore represent respectively the same lengths, weights and capacity. The measures of capacity in France are multiples and divisions of the litre, which is the measure occupied by a kilogram (15434 Troy grains) of distilled water at its greatest density. It exceeds the old Paris pinte by $\frac{1}{14}$, and is equal to 35 fluid ounces and 103 minims, or 1.7608 Imperial pints, or 61.028 English cubic inches. 4½ litres make an Imperial gallon, within about 12 *f*ʒ. The following table will show the relations between the Litre and the Imperial gallon of 277.2738 cubic inches.

Litres.		Cubic Inches.	Gals.	Imperial			
				Pts.	Fl.℥	Fl.ʒ	Min.
$\frac{1}{1000}$	Millilitre	.061028					16.9
$\frac{1}{100}$	Centilitre	.61028				2	49
$\frac{1}{10}$	Decilitre	6.1028			3	4	10.36
1	Litre	61.028		1	15	1	43.69
10	Dekalitre	610.28	2	1	12	1	16.9
100	Hectolitre	6102.8	22	0	1	4	49
1000	Kilolitre	61028.	220	0	16	6	40
10000	Myrialitre	610280.	2201	(or 275⅛ bushels.)			

6053. French Money. In France money is reckoned in *francs* and *centimes*. The centime is the $\frac{1}{100}$ part of a franc, 5 centimes being represented by a sou; so that 20 sous are equivalent to a franc. The same system of coinage is also at present in use in Belgium, Switzerland, and Italy.

6054. Foreign Medicinal Weights. The following are divided as our Apothecaries' weight: The pound of Austria weighs 6482.42 grains; Bavaria, 5556.24; Holland, 5787.75; Lubec, 5697.09; Nuremberg (German pound), 5522.96; Poland, 5533.25; Prussia, 5113.99; Sweden, 5498.01; Venice (sottile), 4349.17.

The division of the following differs in the scruple being divided into 24 grains: Bologna, 5026.32; Lucca, 5162.67; Modena, 5254.61; Parma, 5062.35; Portugal, 5312.23; Rome, 5233.25; Spain, 5325.84; Tuscany, 5240.49; Piedmont (Turin), 5123.49. The Naples pound contains 5490.63 Troy grains; the ounce contains 10 drachms; the scruple 20 grains.

The old Paris pound was divided into 16 ounces; the scruple into 24 grains. The pound by which drugs are weighed in Turkey is the Tchegy, equal to 4957 grains, and is divided into 100 drachms, each drachm into 16 killos, and each killo into 4 grains.

The obolo is half a Spanish scruple; 3 silicua make 1 obolo, and 4 grains a silicua.

The commercial pound in several countries differs from the pharmaceutical. The civil pound of Bavaria and mark of Vienna are each about 19¾ avoirdupois ounces. That of Holland is the French kilogram, or 12 grains more than 2 pounds 3¼ ounces avoirdupois. The mark is half a kilogram. The Coburg commercial pound is nearly 18 ounces avoirdupois.

The unit of the British India system of weights is the tola, equal to 180 Troy grains. 32 tolas are equal to 1 pound Troy. The maund is equal to 100 Troy ounces.

6055. Foreign Money, Weights, and Measures, Compared with American.

	MONEY.		LENGTH.		LIQUID.		WEIGHT.	
	Name of Coin.	Value in American Dollars, Gold.	Name of Measure.	Length in Inches, English.	Name of Measure.	Contents in Cubic Inches.	Name of Weight.	Ounces Avoird
England	Sovereign	4.80	Foot	12	Gallon	277¼	℔ Avoird.	16.
America	Dollar	1.00	Foot	12	Gallon	231	Pound	16.
Austria	Florin	.48½	Foot	12.45	Eimer	3452	Pound	19.76
Denmark	Dollar	.53	Foot	12.35	Anker	2355	Pound	17.65
France	Franc	.19	Metre	39.37	Litre	61.028	Kilogran	35.28
Holland	Florin	.40	Foot	11.14	Anker	2331	Pound	35.28
Portugal	Milreis	1.12	Foot	12.96	Almude	1040	Pound	16.19
Prussia	Dollar	.70	Foot	12.36	Eimer	4200	Pound	16.51
Russia	Rouble	.79½	Foot	12	Veddras	752	Pound	14.44
Spain	Dollar	1.00	Foot	11.03	Arroba	978	Pound	16.23
Sweden			Foot	12	Eimer	4794	Pound	15.

The rate of exchange varies, but the value of money is taken, reckoning silver at $1.20 per ounce.

6056. Foreign Measures.

The kanna of Sweden = nearly 2.62 litres, or about 4 pints 12 ounces imperial.

The pott (half kanne) of Denmark = .9653 litre.

The arroba of Spain = 16.073 litres.

The almude of Portugal = 16.451 litres.

The barile of Naples = 43.6216 litres; of Rome, 58.5416 litres; of Tuscany, 45.584 litres.

The wedro of Russia (10 stof or 30 Russian pounds) = 12.29 litres, or 21 pints 12 ounces 12½ drachms imperial.

The mass of Wurtemburg = 1.537 litres, or about 3 pints 14¾ ounces imperial.

6057. Roman Money. The Romans, like other ancient nations, at first had no coined money, but either exchanged commodities with one another, or used a certain weight of uncoined brass, or other metal. Hence the names which indicated certain pieces of money, when coin came to be used, were the same as those which were used to indicate weights.

6058. Roman Brass Coins. The first brass coin that was used at Rome was called As, made in the reign of Servius Tullius; and being stamped with the heads of oxen, sheep, swine, &c., was called pecunia, from pecus. Hence Æs, brass, is often put for money; Ærarium, for treasury, &c. Some time afterwards the stamp was changed, and on one side it bore the figure of Janus; on the other the beak of a ship. The As originally weighed a pound, but was gradually reduced, and in the first Punic war, Asses were coined of only 2 ounces in weight; in the second Punic war, of only 1 ounce; and in the year of the city 563, of only half an ounce. The other brass coins were the Semissis, the Triens, the Quadrans or Teruncius, and the Sextans. The As, in value of our money, about 1½ cents; the Semissis, half an As; Triens, one-third; Quadrans, or Teruncius, one-fourth; Sextans, one-sixth.

6059. Roman Silver Coins. Silver was first coined in the year of the city 484, five years before the first Punic war; the impressions upon which were usually, on one side, carriages drawn by two or four beasts, and on the reverse, the head of Roma, with a helmet. On some were stamped the figure of Victory. The coins of silver were the Sestertius, Quinarius, Denarius, and Centussis. Sestertius, marked L.L.S. for libra libra semis, or by abbreviation H. S., worth 2½ Asses, or, in our money, 3¾ cents; Quinarius, marked V, worth 5 Asses, 7½ cents; Denarius, marked X, worth 10 Asses, 15½ cents; Centussis, worth 10 Denarii, nearly $1.60.

6060. Roman Gold Coins. Gold coin was first struck in the year of the city 546, in the second Punic war, and called Aureus. The stamps upon it were chiefly the images of the Emperors. The Aureus, at first, was equal in value to 25 Denarii, or 100 Sestertii; or, in our money, to $3.98. Soon afterwards it was debased, and under the later Emperors was worth only $3.70. Accounts were kept in Sestertii and Sestertia. The Sestertium was not a coin, but a shorter expression of 1000 Sestertii, or, in our money, about $40. We find also mentioned the Libra, containing 12 ounces of silver, worth $15, and the Talentum, worth about $965. Besides the ordinary coins, there were various medals struck to commemorate important events, properly called Medallions; for what we commonly term Roman medals were their current money.

6061. Roman Measures of Length. The Roman measures of length or distance were feet, cubits, paces, stadia, and miles.

	M.	Yds.	Ft.	In.
Foot	0	0	0	12
Cubit	0	0	1	6
Passus, or Pace	0	0	5	0
Stadium, or Furlong	0	208	3	0
8 Stadia, or 1000 Paces	1	0	0	0

The Roman Acre contained 240 feet in length, and 120 in breadth, that is, 28,800 square feet.

6062. Roman Weights. The chief weight among the Romans was the As, or Libra, a pound, equal in English Troy weight to 10 ounces 18 dwt. 13 grains; this Libra was divided into 12 parts, Unciæ (ounces), and these Unciæ into several weights of lower denominations.

6063. Roman Measures of Capacity. The most common measure of capacity was the Amphora, called also Quadrantal or Cadus, containing nearly 9 English gallons. They had also a measure called Congius, equal to ⅛ of an Amphora, or 1⅛ gallon English; and another called Sextarius, equal to ⅛ of the Congius, or about 1½ pints.

6064. Roman Division of Time. Romulus is said to have divided the year into 10 months, beginning with March; Numa added the other 2 months. When Julius Cæsar became master of the State, he adjusted the year according to the course of the sun, and assigned to each month the number of days which it still contains. This is the famous Julian Year, which continues in use to this day in all Christian countries, without any variation except that of the old and new style, occasioned by Pope Gregory, A. D. 1582. The Romans divided their months into three parts, by Calends, Nones, and Ides. The 1st day was called the Calends, the 5th day the Nones, and the 13th the Ides; except in March, May, July, and October, when the Nones fell on the 7th, and the Ides on the 15th. The custom of dividing time into weeks was introduced under the Emperors, being derived from the Egyptians; and the days of the week were named from the planets, viz.: Dies Solis, Sunday; Lunæ, Monday; Martis, Tuesday; Mercurii, Wednesday; Jovis, Thursday; Veneris, Friday; Saturni, Saturday. In marking the days, they counted backwards; thus they called the last day of December, Pridie Calendas Januarii, or the day before the Calends of January; the 30th day they called the third day before the Calends of January; and so on through the year. In leap-year the 24th and 25th days of February were both called the 6th day before the Calends of March, and hence this year is called Bissextilis. The day, as with us, was divided into 12 hours, and lasted from six o'clock in the morning till six in the evening. The night was divided into four watches, each consisting of three hours. The Romans had no clocks or watches, and the first dial is said to have been erected in Rome so late as 447 years after the building of the city.

6065. Scriptural Measure of Length.

	M.	Yds.	Ft.	In.	B.C.
A Finger	0	0	0	0	2½
A Hand breadth	0	0	0	3	1¼
A Span	0	0	0	10	2½
A Cubit	0	0	1	9	2½
A Fathom	0	2	1	3	1½
Ezekiel's reed	0	3	0	0	0
Do. according to others	0	3	1	11	0¾
The Measuring Line	0	48	1	11	0
A Stadium or Furlong	0	243	0	6	0
A Sabbath-day's Journey		1216	0	0	0
The Eastern Mile	1	672	0	0	0
A Day's Journey	33	288	0	0	0

6066. Scriptural Liquid Measure.

	Gals.	Qts.	Pts.
The Log	0	0	0¾
The Firkin or Metretes	0	3	1⅛
The Hin	1	1	0
The Bath	7	2	0½
The Homer or Cor	75	2	1¼

6067. Scriptural Dry Measure.

	Bush.	Pks.	Pts.
The Cab	0	0	2¾
The Omer	0	0	5
The Seah	0	1	1
The Ephah	0	3	3¼
The Lethech	4	0	0½
The Homer	8	0	1½

6068. Scriptural Weights.

	Lbs.	Oz.	Dwts.	Gr.
A Shekel	0	0	9	2½
A Maneh	2	3	6	10
A Talent	113	10	1	10

6069. Scriptural Money.

	$	Cts.
A Gerah		2
A Zuzah		12
A Bekah		25
A Shekel (Silver)		50
Golden Daric, or Dram	5	18
A Shekel of Gold	9	00
A Maneh or Mina	29	50
A Talent of Silver	1,707	00
A Talent of Gold	27,320	00

6070. Jewish Method of Reckoning Time. The day, reckoning from sunrise, and the night, reckoning from sunset, were each divided into 12 equal parts, called the 1st, 2nd, 3rd, 4th, &c., hours. The first watch was from sunset to the third hour of the night. The second, or middle watch, was from the third hour to the sixth. The third watch, or cock-crowing, was from the sixth hour to the ninth. The fourth, or morning watch, was from the ninth hour of the night to sunrise.

6071. Russian Money. In Russia, money is calculated in *Roubles* and *Kopeks*, the silver Rouble consisting of 100 Kopeks, and equivalent to about 79½ cents of our money.

6072. Russian Weights. The Russian pound is 6317½ grains, or the weight of 25.019 cubic inches of water. The *Pood*, about 36 pounds, 1½ ounces avoirdupois.

6073. Russian Lineal Measure. The Russian foot is the same as the American.

1 Werst 500 Sashens
1 Sashen = 3 Arsheens
1 Arsheen = 2⅓ Feet

6074. Russian Measures of Capacity. The *Chetwert* is equivalent to 5 bushels 6¼ gallons imperial. The *Tschetwerick*, 5⁷⁄₉ imperial gallons. 10 Tschetwericki make 1 *Kuhl* or *Sark*.

The *Wedro* consists of 3¼ wine gallons, and 40 Wedroja make 1 *Fass*.

6075. Austrian Money is reckoned in *Florins* and *Kreutzers;* the Florin being equivalent to about 48½ cents American.

20 Kreutzers = 1 Zwanziger
60 " = 1 Florin
2 Florins = 1 Thaler
1 Ducat = 4⅔ Florins

6076. Austrian Weights. The Austrian pound is rather less than 1¼ pounds avoirdupois.

1 Sanne = 275 Pounds
1 Pound = 4 Vindlinge
1 Vindlinge = 4 Unzen
1 Unze = 2 Loth

6077. Austrian Lineal Measure. The Austrian *foot* measures 12½ inches; the *Nult* is equivalent to 4⅘ miles.

6078. Austrian Measures of Capacity. The *Muth* is 50⅝ imperial bushels.

1 Muth = 30 Metz
1 Metz = 64 Moasel

The liquid *Mass* or *Kanne* is about 2½ imperial pints, or 1.415 litres.

6079. Roman Money. This was reckoned in *Paoli* and *Bajochi*, the latter being about equal to 1 cent American.

1 Scudo = 10 Paoli
1 Paolo = 10 Bajochi

6080. Prussian Money. The Prussians count their money in *Thalers, Silbergroschen* and *Pfennings.*

1 Thaler = 30 Silbergroschen
1 Silbergroschen = 12 Pfennings.

The Friedrich d'or is equal to 5 Thalers 20 Silbergroschen.

6081. Prussian Weights. The Prussian *pound* is 16½ ounces avoirdupois.

1 Cwt. = 110 Pounds
1 Shipping last = 400 Pounds

6082. Prussian Lineal Measure. The Prussian *foot* is 12⅓ inches English.

1 Ruthe = 12 Feet
1 Foot = 12 Inches
1 Inch = 12 Linien
1 Faden = 6 Feet
1 Mile = 4⅔ Miles English

6083. Prussian Measures of Capacity. The *Scheffel* is equal to 1½ bushels.

1 Wispel = 24 Scheffel
1 Scheffel = 16 Metz

The Prussian liquid quart is equivalent to 1.145 litres, or nearly 2⅖ pints American.

6084. Money of the Netherlands is reckoned in *Guilders* and *Cents*, the guilder (or silver florin) being about 41 cents of our money. The *Ducat* is equivalent to 5.55 guilders, and the *Stuiver* to 5 cents.

6085. Weights Used in the Netherlands. The *pound* is 1 pound 1⅛ ounces avoirdupois.

1 Pound = 10 Lood
1 Lood = 10 Wigtj
1 Wigtj = 10 Korrels

6086. Lineal Measure of the Netherlands. The *ell* is the same as the metre of America.

1 Roede = 10 Ells
1 Ell = ⅒ Palm
1 Palm = 10 Duim
1 Duim = 10 Streep
1 Myl = 1000 Ells or ⅝ mile English

6087. Dry Measure of the Netherlands. The *Mudde* contains a little more than 2¾ bushels imperial.

1 Last = 30 Mudden
1 Mudde = 10 Schepel
1 Schepel = 10 Kop
1 Kop = 10 Maajtes

6088. Liquid Measure of the Netherlands. The *Vat* contains 22⅒ imperial gallons.

1 Vat = 100 Kann
1 Kann = 10 Maajtes
1 Maajte = 10 Vingerh

6089. Portuguese Money. In Portugal, money is reckoned in *Reis*. For the value of the coins see No. 6055

1 Vintem = 20 Reis
1 Crusado = 400 "
1 Milrei = 1000 "
1 Conto de reis = 1000 Milreis

6090. Dutch Weights and Measures. The following are the points in which Holland differs from the rest of the Netherlands.

Dutch. **English.**
1 Foot =11¼ Inches
1 Ell =27$\frac{1}{12}$ "
1 Corn last =10 qrs. 5¼ Winchester Bushels
1 Aam =41 Imperial gallons
1 Hoed = 5 Chaldrons
1 Freight last=4000 Pounds.
1 Ballast last =2000 Pounds

6091. Spanish Money. The *Dollar* of Spain contains 20 *Reals,* and is about the same value as the American. The coins used in different parts of Spain are various; almost every Province having a different system of coinage.

6092. Spanish Weights. The Castilian *Marca* is 7 ounces 3.16 dwts. Troy.

1 Marca = 8 Onzas
1 Onza = 8 Ochaves
1 Ochave = 72 Granos

The quintal is equivalent to 101¾ pounds avoirdupois.

1 Quintal = 4 Arrobas
1 Arroba = 25 Libras
1 Quintal Macho = 6 Arrobas

Precious stones are weighed by the *ounce* of 431½ Troy grains.

1 Ounce = 140 Quilates
1 Quilate = 4 Granos

6093. Spanish Lineal Measure. The *Pie* equals 11⅛ inches, and the *Legua* 4¼ English miles.

1 Estado = 2 Varas
1 Vara = 3 Pies

6094. Spanish Dry Measure. The *Fanega* is 12⅛ imperial gallons.

1 Cahiz = 12 Fanegas
1 Fanega = 12 Almudes
1 Almude = 4 Cuartillos

6095. Spanish Liquid Measure. The *Cantaro* or *Arroba Mayor* contains 3 gallons 3¾ pints imperial; the *Arroba Menor* for oil is 2 gallons 5½ pints imperial.

1 Cantaro = 8 Azumbres
1 Azumbra = 4 Cuartillos
1 Moyo = 16 Cantaros
1 Pipa = 27 "
1 Bota = 30 "

6096. Swedish Money. The *Riksdaler banco* is worth about 40 cents of our money, and is divided into 48 skillings.

6097. Swedish Weights. The *Skal pound* is 15 ounces avoirdupois. The *Schip pound* is equivalent to 400 skal pounds. The *Mark,* used in weighing gold, consists of 6 oz. 16 dwt. Troy.

6098. Swedish Lineal Measure. The Swedish *Foot* is the same as ours.

1 Faam = 3 Alnar
1 Alnar = 2 Feet
1 Foot = 2⅚ Verthum

6099. Swedish Dry Measure. The *Tonn* is equivalent to 4 imperial bushels.

1 Tonn = 8 Quarts
1 Quart = 4 Kappar
1 " = 7 Cans
1 Can = 8 Quarrtiers

6100. Swedish Liquid Measure. The *Fuder* contains 2 pipes.

1 Fuder = 4 Oxhoofte
1 Oxhoofte = 3 Eimer
1 Eimer = 60 Stop

6101. Swiss Money is reckoned in *Francs,* the franc being subdivided into 10 *Batzen.* The value of the franc is about 27 cents. This is the old system. (*See No.* 6053.)

6102. Swiss Weights.

1 Hundred-weight = 50 Kilogrammes
1 Kilogramme = 2 Pounds.

The hundred-weight is equivalent to 110¼ pounds avoirdupois; the pound is therefore about 17⅔ ounces avoirdupois.

6103. Swiss Lineal Measure. The Helvetian foot is equal to 11$\frac{17}{20}$ inches English.

1 Stab or Staff = 2 Ells
1 Ell = 2 Feet
16,000 Feet = 1 Hour or Mile

The Swiss mile is consequently a trifle over 3 English miles.

6104. Swiss Dry Measure. The *Malter* is about 4 bushels 1 gallon Imperial measure.

1 Malter = 10 Viertel
1 Viertel = 10 Immir

6105. Swiss Liquid Measure. The Swiss *Ohm* contains 33 Imperial gallons.

1 Ohm = 100 Maas.

6106. Turkish Money. In Turkey, money is reckond by the *Piaster,* 22 of which are equivalent to $1.00.

1 Sequin = 100 Piasters
1 Piaster = 40 Paras
1 Para = 3 Aspers
1 Piaster (grush) = 100 Aspers.

6107. Turkish Weights. The Turkish *Chequi* is 11⅛ ounces avoirdupois.

1 Cantaro = 44 Okas
1 Batman = 6 Okas
1 Oka = 4 Chequi
1 Chequi = 100 Drachmas.

6108. Turkish Lineal Measure. The Turks use, for measuring length, the large *pik halebi,* or 27 $\frac{9}{10}$ inches; and the small *pik andassa* of 27$\frac{1}{16}$ inches.

6109. Turkish Measures of Capacity. The dry *Killow* contains 7½ imperial gallons; the *Fortin,* 4 killows. A killow of rice should weigh 10 okas. The liquid *almud* contains 1⅔ imperial gallons.

6110. Chinese Money. The Chinese *Tael* is $1.56.

1 Tael = 10 Mace
1 Mace = 10 Candarin
1 Candarin = 10 Cash

6111. Chinese Weights. The *Catty* is 1⅓ pounds avoirdupois.

1 Pecul = 100 Cattys
1 Catty = 16 Taels
1 Tael = 10 Mazas
1 Maza = 10 Candarins
1 Candarin = 10 Cash.

6112. East Indian Money. In Hindostan, money is reckoned in *Rupees, Annas,* and *Pice,* the Rupee being about 45 cents of our money.

1 Rupee = 8 Annas
1 Anna = 12 Pice
10,000 Rupees = 1 Lakh

6113. Mexican Money. The Mexican gold dollar is worth about 96 cents United States coin; the Mexican silver dollar is reckoned equal to the United States gold dollar.

1 Doubloon = 16 Dollars
1 Dollar = 8 Reals.

6114. Monte-Video Money. The *Dollar* or *Peso Corriente* is equal to 80 cents United States coin.

1 Dollar = 8 Reales = 100 Centesimos

6115. Brazilian Money. In Brazil, money is reckoned in *Reis*, 4000 of which are equal to £1 sterling, or $4.84 United States coin.

1 Milreis = 1000 Reis

6116. Brazilian Lineal Measure. The Brazilian *Pe* or Foot is the same as the English foot; the *Palma* is equivalent to 9½ English inches. 10 Palmas equal 1 Braça or 2⅝ English yards. The Braça is also subdivided into 2 *Varas* and 3½ *Covados*. The *Legoa* or mile is about 4¾ English miles.

6117. Brazilian Weights. The weights in ordinary use are as follows, the *Quintal* being equal to 91½ pounds avoirdupois.

1 Quintal = 4 Arrobas
1 Arroba = 32 Arratels

Gold and silver are weighed by the *Marco* of 7 ounces 7¼ dwts Troy.

1 Marco = 8 Onças
1 Onça = 8 Oitavas
1 Oitava = 72 Granos

Precious stones are sold by the *Quilate*, equal to $4\frac{13}{20}$ dwts. Troy.

1 Oitava = 3 Escrupulos
1 Escrupulo = 3 Quilates
1 Quilate = 4 Granos

6118. Brazilian Dry Measure. The Brazilian *Mayo* is equivalent to 22½ imperial bushels.

1 Mayo = 15 Fanegas
1 Fanega = 4 Alqueires

6119. Decimal Approximations for Facilitating Calculations.

Lineal feet	multiplied by	.00019	=	miles.
“ yards	“	.000568	=	“
Square inches	“	.007	=	square feet.
“ feet	“	.111	=	square yards.
“ yards	“	.0002067	=	acres.
Circular inches	“	.00546	=	square feet.
Cylindrical inches	“	.0004546	=	cubic feet.
“ feet	“	.02909	=	cubic yards.
Cubic inches	“	.00058	=	cubic feet.
“ feet	“	.03704	=	cubic yards.
“ “	“	6.2321	=	imperial gallons.
“ inches	“	.003607	=	“ “
Bushels	“	.0476	=	cubic yards.
“	“	1.284	=	cubic feet.
“	“	2218.2	=	cubic inches.
Cubic feet	“	.779	=	bushels.
Cubic inches	“	.00045	=	bushels.
Pounds	“	.009	=	hundredweights.
Pounds	“	.00045	=	tons
Cylindrical feet	“	4.895	=	imperial gallons.
“ inches	“	.002832	=	“ “
Cubic inches	“	.263	=	pounds of cast iron.
“ “	“	.281	=	“ wrought do.
“ “	“	.283	=	“ steel.
“ “	“	.3225	=	“ copper.
“ “	“	.3037	=	“ brass.
“ “	“	.26	=	“ zinc.
“ “	“	.4103	=	“ lead.
“ “	“	.2636	=	“ tin.
“ “	“	.4908	=	“ mercury.
Cylindrical inches	“	.2065	=	“ cast iron.
“ “	“	.2168	=	“ wrought iron.
“ “	“	.2223	=	“ steel.
“ “	“	.2533	=	“ copper.
“ “	“	.2385	=	“ brass.
“ “	“	.2042	=	“ zinc.
“ “	“	.3223	=	“ lead.
“ “	“	.207	=	“ tin.
“ “	“	.3854	=	“ mercury.

6120. Memoranda Connected with Water. 1 cubic foot of water = 62.4 pounds. 1 cubic inch = .036 pounds. 1 gallon imperial = 10 pounds; or = 0.16 cubic feet. 1 cubic foot of water = 6.2321 imperial gallons; or, approximately = 6¼ gallons. 1 cwt. of water = 1.8 cubic feet = 11.2 gallons. 1 ton of water = 35.9 cubic feet = 224 gallons. Cubic feet of water × .557 = cwt. approximately. Cubic feet of water × .028 = tons approximately. 1 cubic foot of sea water = 64.14 pounds. Weight of sea water = weight of fresh water × 1.028.

6121. Pressure of the Atmosphere. In engineering, the common pressure of the atmosphere, 14.6 pounds to the square inch, is taken as a standard of that exerted by other elastic fluids. Thus, steam, or air condensed so as to exert a pressure of 30 pounds to the square inch, is said, in round numbers, to be of 2 atmospheres; at 45 pounds to the inch, 3 atmospheres, &c.

6122. Memoranda Connected with Light. Velocity of light 192,000 miles per second, nearly. Decomposition of light: The seven prismatic colors of a ray of light are violet, indigo, blue, green, yellow, orange, red. Violet is the maximum chemical or actinic color; yellow the maximum illuminating color, and red the heat color.

6123. Force of the Wind.

Miles per Hour.	Feet per Minute.	Feet per Second.	Force in lbs. per Sq. Foot	Description.
1	88	1.47	.005	Hardly perceptible.
2	176	2.93	.020	Just perceptible.
3	264	4.4	.044	
4	352	5.87	.079	Gentle breeze.
5	440	7.33	.123	
10	880	14.67	.492	Pleasant breeze.
15	1320	22.	1.107	
20	1760	29.3	1.970	Brisk gale.
25	2200	36.6	3.067	
30	2640	44.	4.429	High wind.
35	3080	51.3	6.027	
40	3520	58.6	7.870	Very high wind.
45	3960	66.	9.900	
50	4400	73.3	12.304	Storm.
60	5280	88.	17.733	Great storm.
70	6160	102.7	24.153	
80	7040	117.3	31.490	Hurricane.
100	8800	146.6	49.200	

6124. Velocity of Sound. In air, 1.142 feet per second. In water, 4,900 feet. Through iron, 17,500 feet. Through copper, 10,378 feet. Through wood, 12,000 to 16,000 feet.

Distant sounds may be heard on a still day: Human voice, 150 yards. Rifle 5,300 yards. Military band, 5,200 yards. Cannon 35,000 yards.

6125. Heat-conducting Power of Building Materials. Conducting power of substances, slate being 1000.

Slate	1000	Chalk	564
Lead	5210	Asphaltum	451
Flagstone	1110	Oak	336
Portland stone	750	Lath and plaster	255
Brick	600 to 730	Cement	200
Fire-brick	620		

6126. Properties of the Circle. Diameter × 3.14159 = circumference. Diameter × .8862 = side of an equal square. Diameter × .7071 = side of an inscribed square. Radius squared, × 3.14159 = area of circle. Diameter squared, × .7854 = area of circle. Radius × 6.28318 = circumference. Circumference ÷ 3.14159 = diameter. Circumference = $3.54\sqrt{\text{area of circle}}$. Diameter = $1.128\sqrt{\text{area of circle}}$.

6127. To Determine the Weight of Live Cattle. Measure in inches the girth round the breast, just behind the shoulder-blade, and the length of the back from the tail to the forepart of the shoulder-blade. Multiply the girth by the length, and divide by 144. If the girth is less than 3 feet, multiply the quotient by 11; if between 3 feet and 5 feet, multiply by 16; if between 5 feet and 7 feet, multiply by 23; if between 7 feet and 9 feet, multiply by 31. If the animal is lean, deduct $\frac{1}{20}$ from the result. Or: Take the girth and length in feet, multiply the square of the girth by the length, and multiply the product by 3.36. The result will be the answer in pounds. The live weight, multiplied by .605, gives a near approximation to the net weight.

6128. To Measure Corn in the Crib. Corn is generally put up in cribs made of rails, but the rule will apply to a crib of any size or kind. Two cubic feet of good, sound, dry corn in the ear, will make a bushel of shelled corn. To get, then, the quantity of shelled corn in a crib of corn in the ear, measure the length, breadth, and height of the crib, inside of the rail; multiply the length by the breadth, and the product by the height; then divide the result by 2, and you have the number of bushels of shelled corn in the crib. In measuring the height, of course the height of the corn is intended. And there will be found to be a difference in measuring corn in this mode between fall and spring, because it shrinks very much in the winter and spring, and settles down.

6129. Percentage of Pork to Live Weight. The following table shows the proportion of pork to live weight of fat swine:

Live Weight in Stones of 14 pounds.	Per Cent. of Pork.
Above 40 stones	87 to 88
From 35 to 40 stones	84 to 86
" 30 to 35 "	83 to 84
" 25 to 30 "	81 to 82
" 20 to 25 "	80
" 15 to 20 "	77 to 78
Under 15 "	75 to 77

6130. Measures for Housekeepers.

Wheat flour	1 pound		is 1 quart.
Indian meal	1 "	2 oz.	" 1 "
Butter when soft	1 "		" 1 "
Loaf sugar, broken	1 "		" 1 "
White sugar, powd	1 "	1 oz.	" 1 "
Best brown sugar	1 "	2 oz.	" 1 "

Eggs..........10 eggs are 1 pound.
Flour.......... 8 quarts " 1 peck.
Flour.......... 4 pecks " 1 bushel.
16 large table-spoonfuls are..........½ pint.
8 large table-spoonfuls are..........1 gill.
4 large table-spoonfuls are..........½ gill.
2 gills are..........½ pint.
2 pints are..........1 quart.
4 quarts are..........1 gallon.
A common sized tumbler holds..........½ pint.
A common sized wine-glass..........½ gill.
25 drops are equal to.......... 1 tea-spoonful.

6131. Sizes of Drawing Paper.

Wove Antique	52 × 31	in.
Uncle Sam	48 × 120	in.
Double Elephant	40 × 26	in.
Emperor	40 × 60	in.
Atlas	32 × 26	in.
Colombier	33¾ × 23	in.
Elephant	27¾ × 23¼	in.
Imperial	29 × 21¼	in.
Super Royol	27 × 19	in.
Royal	24 × 19	in.
Medium	22 × 18	in.
Demy	19 × 15½	in.
Cap	13 × 16	in.

6132. Barometrical Rules for Prognosticating the Weather. I. After a continuance of dry weather, if the barometer begins to fall slowly and steadily, rain will certainly ensue; but if the fine weather has been of long duration, the mercury may fall for 2 or 3 days before any perceptible change takes place, and the longer time that elapses before rain comes, the longer the wet weather is likely to last.

II. Conversely, if, after a great deal of wet weather, with the barometer below its mean height, the mercury begins to rise steadily and slowly, fine weather will come, though 2 or 3 wet days may first elapse; and the fine weather will be the more permanent, in proportion to the length of time that passes before the perceptible change takes place.

III. On either of the two foregoing suppositions, if the change immediately ensues on the motion of the mercury, the change will not be permanent.

IV. If the barometer rises slowly and steadily for two days together, or more, fine weather will come, though for those two days it may rain incessantly, and the reverse; but if the barometer rises for two days or more during rain, and then, on the appearance of fine weather, begins to fall again, the fine weather will be very transient, and *vice versa*.

V. A sudden fall of the barometer in spring or autumn indicates wind; in summer, during very hot weather, a thunder-storm may be expected; in winter, a sudden fall after frost of some continuance indicates a change of wind with thaw and rain; but in a continued frost a rise of the mercury indicates approaching snow.

VI. No rapid fluctuations of the barometer are to be interpreted as indicating either dry or wet weather of any continuance; it is only the slow, steady, and continued rise or fall, that is to be attended to in this respect.

VII. A rise of the mercury late in the autumn, after a long continuance of wet and windy weather, generally indicates a change of wind to the northern quarters, and the approach of frost.

6133. Melting or Boiling Point of Metals, Liquids, &c.

Degrees Fahr.	
3080°	Platinum melts.
2786	Cast iron melts; 2696° (*Morveau*).
2500	Steel melts.
2016	Gold melts (*Daniell*); 2200° (*Kane*).
1996	Copper melts (*Kane*); 2548° (*Daniell*).
1873	Silver melts (*Makins*); 2233° (*Daniell*).
1869	Brass melts (*Daniell*).
1000	Iron, bright cherry red (*Poillet*).
980	Iron, red heat (*Daniell*).
914	Zinc burns (*Daniell*).
810	Antimony melts.
773	Zinc melts (*Daniell*); 793° (*Gmelin*).
644	Mercury boils (*Daniell*); 662° (*Graham*).
630	Whale oil boils (*Graham*).
612	Lead melts (*Crighton*); 609° (*Daniell*).
600	Linseed oil boils.
560	Sulphur ignites.
545	Sulphuric acid boils (*Phillips*); 620° (*Graham*).
476	Bismuth melts (*Phillips*); 518° (*Gmelin*).
442	Tin melts.
380	Arsenious acid volatilizes.
372	Saturated solution of nitrate of ammonia boils.
356	Metallic arsenic sublimes.
336	Saturated solution of acetate of potassa boils.
320	Cane sugar melts, 320° to 400°, baking heat of an oven.
315	Oil of turpentine boils (*Kane*).
304	Saturated solution of nitrate of lime boils.
302	Etherification ends.
275	Saturated solution of carbonate of potash boils.
256	Saturated solution of acetate of soda boils.
248	Nitric acid, specific gravity 1.42, boils.
238	Saturated solution of nitre boils.
236°	Saturated solution of sal-ammoniac boils.
226	Sulphur melts (*Fownes*); 232° (*Turner*).
220	Saturated solution of alum, carbonate of soda, and sulphate of zinc boils.
218	Saturated solution of chloride of potassa boils.
216	Saturated solution of sulphate of iron, sulphate of copper, and nitrate of lead boils.
213	Water begins to boil in glass (or 213½°).
212	Water boils in metal, barometer at 30 inches.
199	Milk boils.
194	Sodium melts.
185	Nitric acid, specific gravity 1.52, boils.
180	Starch dissolves in water.
176	Rectified spirit boils. Benzole distills.
173	Alcohol, specific gravity 796 to 800, boils.
151	Bees'-wax melts (*Kane*); 142° (*Lepage*).
150	Scalding heat. Pyroxylic spirit boils (*Scanlan*).
145	Albumen coagulates.
140	Chloroform and ammonia, specific gravity .945, boils.
136	Potassium melts (*Daniell*).
132	Acetone (pyroacetic spirit) boils (*Kane*).
130	Butter melts (130° to 140°).
122	Mutton suet and styracine melts.
120	Phosphorus inflames. Friction matches ignite.
116	Bisulphuret of carbon boils (*Graham*).
112	Spermaceti and stearine melt.
111	Beef tallow melts.
110	Highest temperature of the human body (in lockjaw).
106	Mutton tallow melts.
99	Phosphorus melts (99° to 100°).
98	Ether, specific gravity .720, boils. Blood heat.
88	Acetous fermentation ceases. Water boils in a vacuum.
81	Mean temperature at the equator.
77	Vinous fermentation ends; acetous begins.
67	Lowest temperature of the human body (in cholera).
65	Best temperature of a room (65° to 68).
62	Oil of anise liquefies; congeals at 60°.
60	Mean temperature at Rome.
$50\frac{7}{10}$	Mean temperature at London.
42	Sulphuric acid, specific gravity 1.741, congeals (41° to 42°).
41	Mean temperature of Edinburgh.
36	Olive oil freezes.
32	Water freezes.
30	Milk freezes.
28	Vinegar freezes.
20	Strong wine freezes.
— 4	Mixture of snow and salt.
— 7	Brandy freezes.
—39	Mercury freezes (30° to 40°). (*See also Nos.* 7, 3353, 3459 *and* 1687, *&c*).

6134. Weight of Earth, Rocks, &c.

A cubic yard of sand or ground weighs about 30 cwt. Mud, 25 cwt. Marl, 26 cwt. Clay, 31 cwt. Chalk, 36 cwt. Sandstone, 39 cwt. Shale, 40 cwt. Quartz, 41 cwt. Granite, 42 cwt. Trap, 42 cwt. Slate, 43 cwt.

To find the weight of a cubic foot of any of the above, divide the weight of a cubic yard by 27. Thus, a cubic foot of sand weighs $\frac{30}{27}$, or $1\frac{1}{9}$ cwt., equivalent to about 124 pounds.

6135. Weight of Various Minerals.

One cubic foot of water weighs at a temperature of 60° Fahrenheit, 62½ pounds avoirdupois. By ascertaining the specific gravity of a substance and multiplying with 62½ pounds, the exact weight of one cubic foot is obtained.

	Sp. Gr.	Pounds Avoirdupois. Cubic foot Weighs.
Anthracite coal	1.5	94
Antimonial copper, tetrahedrite, or grey copper	5.0	300
Antimonial silver	9.5	600
Antimony ore, grey sulphuret	4.5	279
Antimony metal	6.5	400
Apatite, or phosphate of lime	3.0	186
Arsenical iron pyrites, mispickel	6.0	370
Asbestos	3.0	186
Asphaltum, mineral pitch	1.0	62
Baryta sulphate	4.5	310
Baryta carbonate, witherhite	4.0	248
Bismuth	9.7	600
Bituminous coal	1.5	90
Black lead, graphite	2.0	125
Black jack blende, sulphuret of zinc	4.0	250
Bog iron ore	4.0	250
Brown hæmatite	4.0	250
Building stones, comprising granite, gneiss, syenite, &c.	3.0	186
Calamine	3.3	190
Chromic iron	4.5	260
Copper pyrites	4.0	260
Derbyshire spar, fluor spar	3.0	186
Feldspar	3.0	190
Flint	2.5	110
Loose sand	—	95
Franklinite	5.0	310
Galena	7.5	465
Gold (20 carats)	15.7	1000
" (pure)	19.2	to 1200
Gypsum	2.3	130
Iron—cast iron	—	450
" magnetic ore	5.0	310
" spathic ore	3.0	200
" " pyrites	5.0	310
" pyrrhotine, or magnetic pyrites	4.5	280
" specular ore	4.5	290
" wrought	—	487
Limestone, hydraulic	2.7	150
" magnesian	2.5	130
Manganese, binoxide of	4.8	294
Malachite	4.0	248
Mica	2.8	160
Novaculite, or whetstone	3.0	186
Ochre	3.5	217
Platinum, metal and ores	16 to 19	1116
Porcelain clay	2.0	140
Pyrites, iron	4.5	280
Quartz, pure, compact	2.6	155
" loose, angular, and round sand	—	100
Trap	3.0	186
Vitreous copper, copper glance	5.5	341
Wood tin, stream tin	7.0	434
Zinc, sulphide or blende	4.0	250
Zincite, red zinc ore	5.5	331
Zinc carbonate	4.4	268
Zinc silicate	3.4	200

(*Feuchtwanger*).

6136. Table of the Relative Hardness and Weight of the Principal Precious Stones, &c.

Substances.	Hardness.	Specific Gravity.
Diamond from Ormus	20	3.7
" (pink)	19	3.4
" (bluish)	19	3.3
" (yellowish)	19	3.3
" (cubic)	18	3.2
Ruby	17	4.2
" (pale, from Brazil)	16	3.5
Sapphire	16	3.8
Topaz	15	4.2
" (whitish)	14	3.5
" (Bohemian)	11	2.8
Ruby (spinelle)	13	3.4
Emerald	12	2.8
Garnet	12	4.4
Agate	12	2.6
Onyx	12	2.6
Sardonyx	12	2.6
Amethyst (occidental)	11	2.7
Crystal	11	2.6
Cornelian	11	2.7
Jasper (green)	11	2.7
" (reddish yellow)	9	2.6
Schoerl	10	3.6
Tourmaline	10	3.0
Quartz	10	2.7
Opal	10	2.6
Chrysolite	10	3.7
Zeolite	8	2.1
Fluor	7	3.5
Calcareous spar	6	2.7
Gypsum	5	2.3
Chalk	3	2.7
Glass		2.3 : 3.62
" (plate)		2.5 : 2.6
" (crystal or flint)		3.0 : 3.616

6137. Weight of Hemp and Wire Rope.

HEMP.		IRON WIRE.		STEEL WIRE.	
Circumference.	Lbs. Weight per Fathom	Circumference.	Lbs. Weight per Fathom.	Circumference.	Lbs. Weight per Fathom
2¾	2	1	1	—	—
—	—	1½	1½	1	1
3¾	4	1⅝	2	—	—
—	—	1¾	2½	1½	1½
4½	5	1⅞	3	—	—
—	—	2	3½	1⅝	2
5½	7	2⅛	4	1¾	2½
—	—	2¼	4½	—	—
6	9	2⅜	5	1⅞	3
—	—	2½	5½	—	—
6½	10	2⅝	6	2	3½
—	—	2¾	6½	2⅛	4
7	12	2⅞	7	2¼	4½
—	—	3	7½	—	—
7½	14	3⅛	8	2⅜	5
—	—	3¼	8½	—	—
8	16	3⅜	9	2½	5½
—	—	3½	10	2⅝	6
8½	18	3⅝	11	2¾	6½
—	—	3¾	12	—	—
9½	22	3⅞	13	3¼	8
10	26	4	14	—	—
—	—	4¼	15	3⅜	9
11	30	4⅜	16	—	—
—	—	4½	18	3½	10
12	34	4⅝	20	3¾	12

6138. Miscellaneons Statistics.

TIMBER.	Specific Gravity	Weight in lbs. per Cubic Foot.	Tenacity in lbs. per Square Inch.	Crushing Force in lbs. per Square Inch.
Ash	.8	50	17.200	9.000
Beech	.69	43	11.000	9.000
Birch	.71	44	15.000	5.500
Cedar	.48	30	11.000	5.600
Deal, Christiana	.7	44	12.000	6.000
Elm	.6	37	13.000	10.000
Hornbeam	.75	47	20.000	7.000
Larch	.55	34	9.000	5.500
Memel	.6	37		
Mahogany, Spanish	.8	50	16.000	8.000
Oak, English	.93	58	17.000	10.000
Oak, Canadian	.87	54	10.000	6.000
Pine, red	.65	41	12.000	5.800
Pine, yellow	.45	28	11.000	5.100
Teak, Moulmein	.65	41	15.000	12.000
Yew	.8	50	8.000	
MISCELLANEOUS.				
Asphaltum	.9	56		
Gutta-percha	.98	61		
India-rubber	.94	59		
Ivory	1.8	112		
FLUIDS.			Boiling Point.	Expansion.*
Alcohol	.8	50	173°	.11
Ether	.74	46	100	.07
Oil	.90	56		.08
Water, fresh	1.000	62.4	212	.047
Water, sea	1.028	64.1	213	

GASES.	Water 1.	Comparative Weight (Air being 1.)	Weight of Cubic Foot in Grains.
Air	.0012	1.000	527
Carbonic acid	.0018	1.524	800
Carburetted hydrogen	.0005	.420	220
Hydrogen	.00008	.069	43
Oxygen	.00125	1.103	627

* Expansion of fluids is calculated between 32° and 212° Fahrenheit.

6139. Weight of Copper and Lead.

Weight of a Square Foot of Copper and Lead in pounds, from 1/32 to 1/2 inch in thickness.

Thickness.	Copper.	Lead.
1/32	1.45	1.85
1/16	2.90	3.70
3/32	4.35	5.54
1/8	5.80	7.39
5/32	7.26	9.24
3/16	8.71	11.08
7/32	10.16	12.93
1/4	11.61	14.77
9/32	13.07	16.62
5/16	14.52	18.47
11/32	15.97	20.31
3/8	17.41	22.16
13/32	18.87	24.00
7/16	20.32	25.85
15/32	21.77	27.70
1/2	23.22	29.55

6140. Weight of Cast-Iron Plates.

Weight of Cast-Iron Plates, 12 *inches square.*

Thickness.	Weight.	Thickness.	Weight.
1/8 inch.. 4 lbs.	13 3/8 oz.	5/8 inch .24 lbs.	2 3/4 oz.
1/4 " .. 9 "	10 5/8 "	3/4 " .29 "	0 "
3/8 " ..14 "	8 "	7/8 " .33 "	13 3/8 "
1/2 " ..19 "	5 3/8 "	1 " .38 "	10 3/4 "

6141. Weight of Sheet Iron.

Weight of a Square Foot of Sheet Iron in pounds avoirdupois, the thickness being the number on the wire gauge. No 1 is 5/16 of an inch; No. 4, 1/4; No. 11, 1/8, &c.

No. on Wire Gauge.	Pounds Avoir.	No. on Wire Gauge.	Pounds Avoir.
1	12.5	12	4.62
2	12.	13	4.31
3	11.	14	4.
4	10.	15	3.95
5	9.	16	3.
6	8.	17	2.5
7	7.5	18	2.18
8	7.	19	1.93
9	6.	20	1.62
10	5.68	21	1.5
11	5.	22	1.37

6142. Weight of Boiler Iron.

Weight of a Square Foot of Boiler Iron, from 1/8 to 1 inch thick, in pounds.

Thickness.	Weight.	Thickness.	Weight.
1/8 inch.....5	pounds.	5/8 inch....25	pounds.
3/16 " ...7.5	"	11/16 " ..27.5	"
1/4 " 10	"	3/4 " 30	"
5/16 " ..12.5	"	13/16 " ..32.5	"
3/8 " 15	"	7/8 " 35	"
7/16 " ..17.5	"	15/16 " ..37.5	"
1/2 " 20	"	1 " 40	"
9/16 " ..22.5	"		

6143. Properties of Metals.

METALS.	Weight of a Cubic Inch in Lbs.	Specific Gravity.	Weight of a Cubic Foot in Lbs.	Tenacity in Lbs. per Square Inch.	Crushing Force in Lbs. per sq. Inch.	Melting Point. Fahr.	Expansion between 32° & 212°	Conducting Power.	Specific Heat.
Aluminum	.092	2.56	160			*1800°			
Antimony, cast	.242	6.7	418	1,066		810°	.0011		.0507
Bismuth	.35	9.82	605	3,250		497°	.0014		.0288
Brass, cast	.3	8.4	525	17,978	10,300	1869°	.002		
" wire		8.5	531	49,000					
Copper, cast	.32	8.89	555	19,072	11,700	1996°	.0017		.0949
" sheet		8.95	559	33,000				898	
" wire		9.	562	61,000					
Gold	.7	19.25	1203	20,400		2016°	.0016	1000	.0298
Gun-metal	.3	8.4	525	36,000					
Iron, wrought bar	.28	7.7	481	60,000	38,000		.0012	347	.1100
" Swedish		7.6	475	70,000					
" wire				85,000					
" cast	.26	7.18	448	19,000	92,000	2786°	.0011		
Lead, cast	.41	11.35	709	1,824	7,000	612°	.0028	180	.0293
" sheet				3,328					
Mercury	.49	13.56	847			—39°	.016		.0330
Silver	.38	10.47	654	41,000		1873°	.0019	973	.0557
Steel	.282	7.8	487	120,000		2500°	.0011		
" puddled		7.78	485	80,000					
Tin	.263	7.29	455	5,000	15,000	442°	.0021	304	.0514
Zinc	.253	7.	437	8,000		773°	.0029	363	.0927

* Approximate; no well-authenticated experiments on Aluminum.

6144. Weight of Round and Square Shafts of Wrought Iron, 1 Foot Long.

Size in Inches.	Weight in Lbs.		Size in Inches.	Weight in Lbs.	
	Round.	Square.		Round.	Square.
⅛	.042	.053	4¾	59.7	76.0
¼	.166	.211	5	66.2	84.3
⅜	.372	.474	5¼	72.9	92.9
½	.662	.843	5½	80.1	102
⅝	1.03	1.32	5¾	87.5	111
¾	1.49	1.90	6	95.3	121
⅞	2.03	2.58	6¼	103	132
1	2.65	3.37	6½	112	142
1⅛	3.35	4.27	6¾	121	154
1¼	4.14	5.27	7	130	165
1⅜	5.00	6.37	7¼	139	177
1½	5 97	7.58	7½	149	190
1⅝	7.00	8.90	7¾	159	203
1¾	8.11	10.3	8	169	216
1⅞	9.31	11.8	8¼	180	229
2	10.6	13.5	8½	191	244
2⅛	11.9	15.2	8¾	203	258
2¼	13.4	17.1	9	214	273
2⅜	14.9	19.0	9¼	227	288
2½	16.5	21.1	9½	239	304
2⅝	18.2	23.2	9¾	252	320
2¾	20.0	25.5	10	265	337
2⅞	21.9	27.9	10½	292	372
3	23.8	30.3	11	320	408
3¼	28.0	35.6	11½	350	448
3½	32.4	41.3	12	381	486
3¾	37.2	47.4	12½	414	527
4	42.4	54.0	13	447	570
4¼	47.8	60.9	13½	483	614
4½	53.6	68.2	14	519	661

6145. Weights of Wrought-Iron and Steel.

Round Iron.—Multiply the square of the diameter in inches, by the length in feet, and by 2.63, and the product will be the weight in pounds avoirdupois, nearly.

Square Iron.—Multiply the area of the end of the bar in inches, by the length in feet, and by 3.36; the product will be the weight in pounds avoirdupois, nearly.

Square, Angled, T, *Convex, or any figure of Beam Iron.*—Ascertain the area of the end of each figure of bar, in inches, then multiply the area by the length in feet, and that product by 10, and divide by three; the remainder will be the weight in pounds, nearly.

Square Cast Steel.—Multiply the area of the end of the bar in inches, by the length in feet, and that product by 3.4; the product will be the weight in pounds, nearly.

Round Cast Steel.—Multiply the square of the diameter in inches, by the length in feet, and that product by 2.67; the product will give the weight in pounds avoirdupois, nearly.

6146. Number of Nails per Pound.

The following table shows the length of the various sizes of nails and the number of each in a pound:

Size.	Length.	Number.
3-penny,	1 inch long,	557 per pound.
4 "	1¼ "	353 "
5 "	1¾ "	232 "
6 "	2 "	167 "
7 "	2¼ "	141 "
8 "	2½ "	101 "
10 "	2¾ "	98 "
12 "	3 "	54 "
20 "	3½ "	34 "
Spikes	4 "	16 "
"	4½ "	12 "
"	5 "	10 "
"	6 "	7 "
"	7 "	5 "

The term "penny," designating the size of nails, appears to mean "pound." Ten-penny nails weighing 10 pounds per thousand, four-penny nails 4 pounds per thousand, &c. (*Webster.*) This is probably the weight the nails were originally made; according to the foregoing table they have since learned economy in the material.

6147. Calendar for Ascertaining on what Day of the Week any Given Day will Fall within the Present Century.

YEARS 1801 TO 1900.

											31 Jan.	28 Feb.	31 Mar.	30 April.	31 May.	30 June.	31 July.	31 Aug.	30 Sept.	31 Oct.	30 Nov.	31 Dec.
1801	1807	1818	1829	1835	1846	1857	1863	1874	1885	1891	4	7	7	3	5	1	3	6	2	4	7	2
1802	1813	1819	1830	1841	1847	1858	1869	1875	1886	1897	5	1	1	4	6	2	4	7	3	5	1	3
1803	1814	1825	1831	1842	1853	1859	1870	1881	1887	1898	6	2	2	5	7	3	5	1	4	6	2	4
1805	1811	1822	1833	1839	1850	1861	1867	1878	1889	1895	2	5	5	1	3	6	1	4	7	2	5	7
1806	1817	1823	1834	1845	1851	1862	1873	1879	1890		3	6	6	2	4	7	2	5	1	3	6	1
1809	1815	1826	1837	1843	1854	1865	1871	1882	1893	1899	7	3	3	6	1	4	6	2	5	7	3	5
1810	1821	1827	1838	1849	1855	1866	1877	1883	1894	1900	1	4	4	7	2	5	7	3	6	1	4	6

To ascertain any day of the week in any year of the present century, first look in the table of years for the year required, and under the months are figures which refer to the corresponding figures at the head of the columns of days below.

For Example: To find what day of the week January 1 will be in the year 1873, look in the table of years for 1873, and in a parallel line under January is figure 3, which directs to column 3, in which it will be seen that January 1 will fall on Wednesday.

LEAP-YEARS.

				31 Jan.	28 Feb.	31 Mar.	30 April.	31 May.	30 June.	31 July.	31 Aug.	30 Sept.	31 Oct.	30 Nov.	31 Dec.
1804	1832	1860	1888	7	3	4	7	2	5	7	3	6	1	4	6
1808	1836	1864	1892	5	1	2	5	7	3	5	1	4	6	2	4
1812	1840	1868	1896	3	6	7	3	5	1	3	6	2	4	7	2
1816	1844	1872		1	4	5	1	3	6	1	4	7	2	5	7
1820	1848	1876		6	2	3	6	1	4	6	2	5	7	3	5
1824	1852	1880		4	7	1	4	6	2	4	7	3	5	1	3
1828	1856	1884		2	5	6	2	4	7	2	5	1	3	6	1

1	2	3	4	5	6	7
Mon..... 1	Tues..... 1	Wed..... 1	Thur..... 1	Fri...... 1	Sat...... 1	Sun...... 1
Tues..... 2	Wed..... 2	Thur.... 2	Fri...... 2	Sat...... 2	Sun...... 2	Mon..... 2
Wed..... 3	Thur.... 3	Fri...... 3	Sat...... 3	Sun...... 3	Mon..... 3	Tues..... 3
Thur.... 4	Fri...... 4	Sat...... 4	Sun...... 4	Mon..... 4	Tues..... 4	Wed..... 4
Fri...... 5	Sat...... 5	Sun...... 5	Mon..... 5	Tues..... 5	Wed..... 5	Thur.... 5
Sat...... 6	Sun...... 6	Mon..... 6	Tues..... 6	Wed..... 6	Thur.... 6	Fri...... 6
Sun...... 7	Mon..... 7	Tues..... 7	Wed..... 7	Thur.... 7	Fri...... 7	Sat...... 7
Mon...... 8	Tues..... 8	Wed..... 8	Thur.... 8	Fri...... 8	Sat...... 8	Sun...... 8
Tues..... 9	Wed..... 9	Thur.... 9	Fri...... 9	Sat...... 9	Sun...... 9	Mon..... 9
Wed......10	Thur.....10	Fri......10	Sat..... 10	Sun......10	Mon......10	Tues.....10
Thur.....11	Fri......11	Sat......11	Sun......11	Mon......11	Tues.....11	Wed.....11
Fri.......12	Sat......12	Sun......12	Mon.....12	Tues.....12	Wed.....12	Thur....12
Sat.......13	Sun......13	Mon.....13	Tues.....13	Wed.....13	Thur....13	Fri......13
Sun......14	Mon.....14	Tues.....14	Wed.....14	Thur.... 14	Fri......14	Sat......14
Mon.....15	Tues.....15	Wed.....15	Thur.....15	Fri.......15	Sat......15	Sun......15
Tues.....16	Wed.....16	Thur.....16	Fri.......16	Sat...... 16	Sun......16	Mon.....16
Wed.....17	Thur....17	Fri.......17	Sat.......17	Sun......17	Mon.....17	Tues.....17
Thur....18	Fri......18	Sat...... 18	Sun......18	Mon.....18	Tues.....18	Wed.....18
Fri.......19	Sat......19	Sun......19	Mon.....19	Tues.....19	Wed.....19	Thur.... 19
Sat.......20	Sun......20	Mon.....20	Tues.....20	Wed.....20	Thur.... 20	Fri......20
Sun......21	Mon.....21	Tues.....21	Wed.....21	Thur.... 21	Fri......21	Sat......21
Mon.....22	Tues.....22	Wed.....22	Thur....22	Fri......22	Sat......22	Sun......22
Tues.....23	Wed..... 23	Thur.....23	Fri...... 23	Sat...... 23	Sun......23	Mon.....23
Wed..... 24	Thur....24	Fri.......24	Sat.......24	Sun......24	Mon.....24	Tues.....24
Thur.... 25	Fri......25	Sat...... 25	Sun......25	Mon.....25	Tues.....25	Wed.....25
Fri...... 26	Sat......26	Sun...... 26	Mon.....26	Tues.....26	Wed..... 26	Thur....26
Sat.......27	Sun......27	Mon.....27	Tues.....27	Wed.....27	Thur....27	Fri......27
Sun......28	Mon.....28	Tues.....28	Wed.....28	Thur....28	Fri......28	Sat......28
Mon.....29	Tues.....29	Wed..... 29	Thur.....29	Fri......29	Sat......29	Sun......29
Tues.....30	Wed.....30	Thur....30	Fri.......30	Sat......30	Sun......30	Mon.....30
Wed.....31	Thur....31	Fri.......31	Sat......31	Sun......31	Mon.....31	Tues.....31

6148. Proportions of a Beautiful Body. The height should be exactly equal to the distance between the tips of the middle fingers of either hand when the arms are fully extended. Ten times the length of the hand, or seven and a half times the length of the foot, or five times the diameter of the chest from one armpit to the other, should also each give the height of the whole body. The distance from the junction of the thighs to the ground should be the same as from that point to the crown of the head. The knee should be precisely midway between the same point and the bottom of the heel. The distance from the elbow to the tip of the middle finger should be the same as from the elbow to the middle line of the breast. From the top of the head to the level of the chin should be the same as from the level of the chin to that of the armpits, and from the heel to the toe.

6149. Loss Sustained by Different Substances in Drying.

Grains.		Dried at	Lose Grains.
100	Gallic Acid	212°	9.5
100	Sulphate of Quinine	212°	14.4
100	Arseniate of Soda	300°	40.38
100	Alum	400°	47.
100	Carbonate of Soda	Dull Redness	63.
100	Phosphate of Soda	"	63.
100	Sulphate of Soda	"	56.
100	Carbonate of Potassa	"	16.

Grains.		Dried at	Leave Grains.
29	Oxide of Silver	Redness	27 Metallic Silver
10	Oxalate of Cærium	"	4.8 Oxide with Peroxide
100	Oxalate of Iron	"	27 Peroxide of Iron
50	Tartrate of Iron	"	15 Sesquioxide of Iron
50	Carbonate of Magnesia	"	22 Magnesia

6150. Table of Symbols and Equivalents of Metallic Elements. The specific gravity of the following are given at water standard. The equivalents are multiples of hydrogen, which is adopted as the basis, or 1.

	Symbol.	Equivalent.		Sp. Gr.
		U. S. Dis.	Ure.	
Aluminum	Al	13.70	13.67	2.56
Antimony (Stibium)	Sb	122.00	129.00	6 70
Arsenic	As	75.00	75.00	5.67
Barium	Ba	68.70	68.50	4.70
Bismuth	Bi	210.00	213.00	9.80
Boron	B	10.90	11.00	2.68
Cadmium	Cd	55.80	56.00	8.63
Calcium	Ca	20.00	20.00	1.58
Cerium	Ce	46.00	46.00	
Chromium	Cr	26.30	26.27	5.90
Cobalt	Co	29.50	29.50	8.53
Columbium (Tantalium)	Ta	185.00		
Cæsium	Cæ		123.00	
Copper (Cuprum)	Cu	31.70	32.00	8.72
Didymium	D	47.50	48.00	
Erbium	E	56.30		
Glucinium	G	7.00	6.97	
Gold (Aurum)	Au	199.00	98.33	19.4
Ilmenium	Il	60.20		
Indium	In	74.00		
Iridium	Ir	98.80	98.56	18.63
Iron (Ferrum)	Fe	28.00	28.00	7.84
Lantanium	La	44.30		
Lead (Plumbum)	Pb	103.60	104.00	11.30
Lithium	L	7.00	7.00	.59
Magnesium	Mg	12.00	12.00	1.75
Manganese	Mn	27.70	26.00	8.00
Mercury (Hydrargyrum)	Hg	200.00	200.00	13.50
Molybdenum	M	48.00	48.00	8.60
Nickel	Ni	29.50	29.50	8.63
Niobium	Nb	94.00		
Norium	No			
Osmium	Os	99.70	99.41	10.00
Palladium	Pd	53.30	53.24	11.50
Pelopium	Pe			
Platinum	Pt	98.90	99.00	21.50
Potassium (Kalium)	K	39.20	39.00	.86
Rhodium	Ro	52.20	52.16	11.20
Rubidium	Rb	85.40	85.00	
Ruthenium	Ru	52.20	52.11	8.60
Silicon	Si	21.30	21.00	
Silver (Argentum)	Ag	108.00	108.00	10.43
Sodium (Natrium)	Na	23.30	23.00	.97
Strontium	Sr	43.80	44.00	2.54
Tellurium	Te	64.00	64.08	6.30
Terbium	Tb			
Thallium	Tl	204.00		
Thorium	Th	59.60	59.50	
Tin (Stannum)	Sn	59.00	59.00	7.29
Titanium	Ti	25.00	24.12	5.28
Tungsten (Wolfram)	W	92.00	92.00	17.20
Uranium	U	60.00	60.00	10.15
Vanadium	V	51.20	68.46	
Yttrium	Y	30.85		
Zinc	Zn	32.30	32.52	6.91
Zirconium	Zr	33.60	33.58	

6151. Table of Symbols and Equivalents of Non-Metallic Elements. The specific gravity of these are given in their gaseous form, air being the standard or 1.000. The equivalents are multiples of hydrogen which is adopted as the basis or 1.

	Symbol.	Equivalent.		Specific Gravity.
		U. S. Dis.	Ure.	
Bromine	Br	78.4	80.0	5.4110
Carbon	C	6.0	6.0	.8290
Chlorine	Cl	35.5	35.5	2.4530
Fluorine	Fl	18.7	19.0	1.3270
Hydrogen	H	1.0	1.0	.0692
Iodine	I	126.3	127.0	8.7827
Nitrogen	N	14.0	14.0	.9713
Oxygen	O	8.0	8.0	1.1056
Phosphorus	P	32.0	32.0	4.2840
Selenium	Se	40.0	40.0	7.6960
Sulphur.	S	16.0	16.0	2.2140

6152. To Reduce Parts by Volume or Measure to Parts by Weight. Multiply the parts by volume or measure by the specific gravity of the different substances; the result will be parts by weight.

6153. To Find the Length of the Day or Night. To find the length of any day, double the time of sunset. Double the hour of sunrise will be the length of the night.

6154. To Reduce a Liquid to a Given Density. It has been already stated in No. 52 that the actual weight of any substance may be found by weighing an exactly equal bulk of water, and multiplying the weight found by the specific gravity of the substance; the product is the actual weight. To simplify this, suppose that a liquid has a specific gravity of 1.325; also that a certain bulk of water (say any 1 measure) weighs 100 grains; then a similar bulk (1 measure) of the substance would weigh $100 \times 1.325 = 132.5$ grains. Now, supposing we wish to reduce the weight of this liquid, so that 1 measure of it shall weigh only 115.5 grains (that is, shall have a specific gravity of 1.155), how much water, whose specific gravity is 1.000, must be added to it to produce this result?

From the nature of the proposition, it follows that the bulk of the substance (1) multiplied by its specific gravity (1.325), added to the bulk of added (unknown) water multiplied by its specific gravity (1.000), must be equal to the aggregate bulk of the substance and of the water combined, multiplied by its required specific gravity (1.155).

Putting the above words into shape, and assuming x to be the required bulk or quantity of water

$$(1 \times 1.325) + (x \times 1.000) = (1 + x) \times 1.155$$

$$\text{or} \quad 1.325 + 1.000x = 1.155 + 1.155x$$

by subtracting 1.155 and 1.000 x from each side we have

$$.170 = .155x$$

in other words the required bulk of water, ... $x = \frac{.170}{.155} = 1.097$

If, as supposed above, the measure assumed was such that it weighed 100 grains of water, we should have to add $109\frac{7}{10}$ grains of water to 1 measure of the substance to produce a mixture of specific gravity 1.155.

6155. Gay Lussac's Light Areometer Reduced to Specific Gravity. This instrument ranges from 0° to 50°, 0° corresponding with water at 59° Fahr.

Degree.	Sp. Gr.	Diff.	Degree.	Sp. Gr.	Diff.
0°	1.0000	.0095	30°	.7692	.0057
5	.9524	.0087	35	.7407	.0053
10	.9090	.0079	40	.7143	.0049
15	.8696	.0073	45	.6897	.0044
20	.8333	.0067	50	.6667	
25	.8000	.0062			

This table gives the specific gravity corresponding to every 5 degrees of the scale. To find the specific gravity of intermediate degrees, the average difference between each degree is given in the third column, each given difference referring to the four degrees following the degree opposite which the difference is placed. Thus: To find the specific gravity corresponding with 33 degrees of the scale, look in the table for the specific gravity of the nearest lower degree given, in this instance 30°; and we find .7692; 33° is 3° more than 30°, hence we must deduct 3 times the given difference (.0057), or .0171; this last deducted from .7692 = .7521, which is the approximate specific gravity corresponding to 33° of the scale.

The intermediate degrees of other areometers may be determined in a similar manner.

The corresponding degrees of different areometers may also be found by a comparison with their respective specific gravities; allowance being made for difference of temperature.

Information showing the practical use of some of the areometers will be found in Nos. 58 to 68.

6156. Gay Lussac's Heavy Areometer Reduced to Specific Gravity. This areometer ranges from 0° to 50°, 0° representing water at 59° Fahr.

Degree.	Sp. Gr.	Diff.	Degree.	Sp. Gr.	Diff.
0°	1.0000	.0105	30°	1.4286	.0220
5	1.0526	.0117	35	1.5385	.0256
10	1.1111	.0131	40	1.6667	.0303
15	1.1765	.0147	45	1.8182	.0363
20	1.2500	.0167	50	2.0000	
25	1.3333	.0191			

The specific gravity of the intermediate degrees is found in the same manner as in No. 6155, only that the differences must be added instead of subtracted.

6157. Gay Lussac's Alcoholmeter Reduced to Specific Gravity. This instrument exhibits the percentage of alcohol by volume in different alcoholic mixtures at 59° Fahr.

Per cent. of Alcohol by Volume.	Sp. Grav.	Diff.	Per cent. of Alcohol by Volume.	Sp. Grav.	Diff.
100	.7947	.0044	60	.9141	.0021
95	.8168	.0036	55	.9248	.0020
90	.8346	.0031	50	.9348	.0018
85	.8502	·0028	45	.9440	.0016
80	.8645	.0031	40	.9523	.0014
75	.8799	.0022	35	.9595	.0002
70	.8907	.0024	10	.9656	.0034
65	.9027	.0023	0	1.0000	

The specific gravity of the intermediate degrees is found as explained in No. 6155, only that the difference must be added instead of subtracted.

6158. Beck's Heavy Areometer Reduced to Specific Gravity. This ranges from 0° to 76°, 0° corresponding with water at 54½° Fahr.

Degree.	Sp. Gr.	Diff.	Degree.	Sp. Gr.	Diff.
0°	1.0000	.0061	45°	1.3600	.0113
5	1.0303	.0064	50	1.4167	.0123
10	1.0625	.0068	55	1.4782	.0134
15	1.0968	.0073	60	1.5454	.0147
20	1.1333	.0078	65	1.6190	.0162
25	1.1724	.0084	70	1.7000	.0179
30	1.2143	.0090	75	1.7895	
35	1.2592	.0097	76	1.8085	
40	1.3077	.0105			

The specific gravity of the intermediate degrees is obtained as shown in No. 6155, the differences being added instead of subtracted.

6159. Beck's Light Areometer Reduced to Specific Gravity. The scale on this areometer marks from 0° to 70°, 0° representing water at 54½° Fahr.

Deg.	Sp. Gr.	Diff.	Deg.	Sp. Gr.	Diff.
0°	1.0000	.0057	40°	.8095	.0038
5	.9714	.0054	45	.7907	.0036
10	.9444	.0051	50	.7727	.0034
15	.9189	.0048	55	.7555	.0033
20	.8947	.0046	60	.7391	.0031
25	.8718	.0043	65	.7234	.0030
30	.8500	.0041	70	.7083	
35	.8293	.0040			

The equivalents of the intermediate degrees may be found by the method given in No. 6155.

6160. Dutch Light Areometer Reduced to Specific Gravity. This areometer ranges from 0° to 60°, 0° denoting water.

Deg.	Sp. Gr.	Diff.	Deg.	Sp. Gr.	Diff.
0°	1.0000	.0067	35°	.8045	.0044
5	.9664	.0063	40	.7826	.0041
10	.9351	.0059	45	.7619	.0039
15	.9057	.0055	50	.7423	.0037
20	.8780	.0052	55	.7236	.0035
25	.8521	.0049	60	.7059	
30	.8276	.0046			

The specific gravity of the intermediate degrees may be found in the same manner as directed in No. 6155.

6161. The Heavy Areometer of Brix. This instrument is graduated from 0° to 200°, 0° denoting water at 60° Fahr.

Deg.	Sp. Gr.	Diff.	Deg.	Sp. Gr.	Diff.
0°	1.0000	.0025	105°	1.3559	.0047
5	1.0127	.0026	110	1.3793	.0048
10	1.0256	.0027	115	1.4035	.0050
15	1.0390	.0027	120	1.4286	.0052
20	1.0526	.0028	125	1.4545	.0054
25	1.0667	.0029	130	1.4815	.0056
30	1.0811	.0029	135	1.5094	.0058
35	1.0058	.0030	140	1.5385	.0060
40	1.1111	.0031	145	1.5686	.0063
45	1.1268	.0032	150	1.6000	.0065
50	1.1429	.0033	155	1.6326	.0068
55	1.1594	.0034	160	1.6667	.0071
60	1.1765	.0035	165	1.7021	.0074
65	1.1940	.0036	170	1.7391	.0077
70	1.2121	.0037	175	1.7777	.0081
75	1.2308	.0038	180	1.8182	.0085
80	1.2500	.0039	185	1.8605	.0089
85	1.2698	.0040	190	1.9047	.0093
90	1.2900	.0042	195	1.9512	.0098
95	1.3115	.0044	200	2.0000	
100	1.3333	.0045			

The specific gravity of the intermediate degrees is obtained as in No. 6155, by adding the differences instead of subtracting them.

6162. The Light Areometer of Brix. This areometer is graded from 0° to 200°, 0° corresponding with water at 60° Fahr.

Degree.	Sp. Gr.	Diff.	Degree.	Sp. Gr.	Diff.
0°	1.0000	.0025	105°	.7921	.0016
5	.9876	.0024	110	.7843	.0015
10	.9756	.0024	115	.7767	.0015
15	.9638	.0023	120	.7692	.0015
20	.9524	.0022	125	.7619	.0014
25	.9412	.0022	130	.7547	.0014
30	.9302	.0021	135	.7477	.0014
35	.9195	.0021	140	.7407	.0014
40	.9091	.0020	145	.7339	.0013
45	.8989	.0020	150	.7273	.0013
50	.8889	.0020	155	.7207	.0013
55	.8791	.0019	160	.7143	.0013
60	.8696	.0019	165	.7080	.0012
65	.8602	.0018	170	.7018	.0012
70	.8511	.0018	175	.6957	.0012
75	.8421	.0018	180	.6897	.0012
80	.8333	.0017	185	.6838	.0012
85	.8247	.0017	190	.6780	.0011
90	.8163	.0016	195	.6723	.0011
95	.8081	.0016	200	.6667	
100	.8000	.0016			

To obtain the specific gravity of the intermediate degrees see No. 6155.

6163. Dutch Heavy Areometer Reduced to Specific Gravity. The range of this instrument is from 0° to 75°, 0° corresponding with water.

Deg.	Sp. Gr.	Diff.	Deg.	Sp. Gr.	Diff.
0°	1.0000	.0072	40°	1.3846	.0140
5	1.0359	.0077	45	1.4545	.0155
10	1.0746	.0083	50	1.5319	.0172
15	1.1163	.0090	55	1.6180	.0193
20	1.1613	.0098	60	1.7143	.0217
25	1.2101	.0106	65	1.8228	.0246
30	1.2631	.0116	70	1.9459	.0282
35	1.3211	.0127	75	2.0869	

The specific gravity of the intermediate degrees is easily obtained by following the directions laid down in No. 6155, adding the difference instead of subtracting it.

6164. Twaddel's Areometer Reduced to Specific Gravity. The range of this areometer or saccharometer is from 0° to 200°, 0° corresponding with water.

Degrees.	Sp. Grav.	Degrees.	Sp. Grav.
0°	1.000	105°	1.525
5	1.025	110	1.550
10	1.050	115	1.575
15	1.075	120	1.600
20	1.100	125	1.625
25	1.125	130	1.650
30	1.150	135	1.675
35	1.175	140	1.700
40	1.200	145	1.725
45	1.225	150	1.750
50	1.250	155	1.775
55	1.275	160	1.800
60	1.300	165	1.825
65	1.325	170	1.850
70	1.350	175	1.875
75	1.375	180	1.900
80	1.400	185	1.925
85	1.425	190	1.950
90	1.450	195	1.975
95	1.475	200	2.000
100	1.500		

In the above table the difference between the degrees is .005, throughout; the specific gravity of the intermediate degrees can be found by following the method given in No. 6155, adding instead of deducting the difference. (*See No.* 68.)

6165. Baumé's Heavy Areometer. This instrument marks from 0° to 75°, 0° being water at 63½° Fahr.

Deg.	Sp. Gr.	Diff.	Deg.	Sp. Gr.	Diff.
0°	1.0000	.0071	40°	1.3746	.0135
5	1.0353	.0076	45	1.4421	.0149
10	1.0731	.0081	50	1.5166	.0165
15	1.1138	.0088	55	1.5992	.0184
20	1.1578	.0095	60	1.6914	.0207
25	1.2053	.0103	65	1.7948	.0234
30	1.2569	.0112	70	1.9117	.0266
35	1.3131	.0123	75	2.0448	

The specific gravity of the intermediate degrees can be obtained as directed in No. 6155, adding the difference instead of subtracting. A ready method of calculating the specific gravity corresponding to the degrees of this areometer, sufficiently correct for common purposes, will be found in No. 66; the table given in No. 65 is made on that principle, and based on 1000 as the unit representing water, instead of 1.

6166. Baumé's Light Areometer. This areometer ranges from 10° to 60°, 10° denoting water at 54½° Fahr.

Deg.	Sp. Gr.	Diff.	Deg.	Sp. Gr.	Diff.
10°	1.0000	.0066	40°	.8294	.0046
15	.9669	.0062	45	.8065	.0043
20	.9358	.0058	50	.7848	.0041
25	.9067	.0055	55	.7642	.0039
30	.8794	.0051	60	.7447	
35	.8537	.0049			

The specific gravity of the intermediate degrees is found by following the directions given in No. 6155. A simple method for converting the degrees of this areometer into specific gravity, applicable in cases where great accuracy is not required, is given in No. 66. A table, similar to the above, will be found in No. 62, sufficiently accurate for general practical purposes.

Miscellaneous Receipts.

These consist mainly of such receipts as could not be properly included in any division of the work; embracing also a few additional general receipts, whose merits demanded their insertion, obtained too late for classification under their proper headings.

6168. To Prepare Skeleton Leaves. The object in view is to destroy what may be called the fleshy part of the leaf, as well as the skin, leaving only the ribs or veins. The most successful, and probably the simplest way to do this, is to soak the leaves in rain-water till they are decomposed. For this purpose, when the leaves are collected, they should be placed in an earthenware pan or a wooden tub, kept covered with rain-water, and allowed to stand in the sun. In about 2 weeks time they should be examined, and if found pulpy and decaying, will be ready for skeletonizing, for which process some cards, a camel's-hair brush, as well as one rather stiff (a tooth-brush, for instance), will be required. When all is prepared, gently float a leaf onto a card, and with the soft brush carefully remove the skin. Have ready a basin of clean water, and when the skin of one side is completely removed, reverse the card in the water, and slip it under the leaf, so that the other side is uppermost. Brush this to remove the skin, when the fleshy part will most likely come with it; but if not, it will readily wash out in the water. If particles of the green-colored matter still adhere to the skeleton, endeavor to remove them with the soft brush; but if that is of no avail, the hard one must be used. Great care will be necessary to avoid breaking the skeleton, and the hard brush should only be used in a perpendicular direction (a sort of gentle tapping), as any horizontal motion or brushing action will infallibly break the skeleton. Never attempt to touch the leaves or the skeleton in this state with the fingers, as when they are soft their own weight will often break them. Well-grown leaves should always be chosen, and be thoroughly examined for flaws before soaking. Leaves containing much tannin cannot be skeletonized by this process, but are generally placed in a box with a number of caddis worms, which eat away the fleshy parts, when the skeletons can be bleached by the method given in the next receipt. Holly leaves must be placed in a separate vessel, on account of their spines, which would be apt to damage other leaves; they make beautiful skeletons, and are sufficiently strong to be moved with the fingers. (*See No.* 6170.)

6169. To Bleach Skeleton Leaves. A good way of bleaching skeleton leaves is to prepare a solution of chloride of lime, which must be allowed to settle, and the clear liquid poured into a basin, in which the skeletons may be put by floating them off the card. It is as well to have half a dozen ready to bleach at once, as they require watching, and if allowed to remain in the liquid too long will fall to pieces. From 2 to 4 hours will generally suffice to bleach the skeleton of all ordinary leaves, after which they should be washed in several changes of water, and finally left in clean water for ½ hour. After the leaf has been sufficiently washed it should be floated onto a card and dried as quickly as possible, care being taken to arrange the skeleton perfectly flat, and as near as possible to the natural shape. This can be done with the assistance of the soft brush. When dry the skeleton should be perfectly white, and may be mounted on dark backgrounds, as black velvet or paper. (*See No.* 6171.)

6170. Quick Method of Preparing Skeleton Leaves. A solution of caustic soda is to be made by dissolving 3 ounces washing soda in 2 pints boiling water, and adding 1½ ounces quicklime previously slacked; boil for 10 minutes, decant the clear solution, and bring it to the boil. During ebullition add the leaves; boil briskly for about an hour, occasionally adding hot water to supply the place of that lost by evaporation. Take out a leaf, put it into a vessel of water, and rub it between the fingers under the water. If the skin and pulpy matter separate easily, the rest of the leaves may be removed from the solution, and treated in the same way; but if not, then the boiling must be continued for some time longer. (*See No.* 6168.)

6171. To Bleach Skeleton Leaves. To bleach the skeleton leaves, mix about 1 drachm chloride of lime with 1 pint water, adding sufficient acetic acid to liberate the chlorine. Steep the leaves in this until they are whitened (about 10 minutes), taking care not to let them stay in too long, as they are apt to become brittle. Put them into clean water, and float them out on pieces of paper. Lastly, remove them from the paper before they are quite dry, and place them in a book or botanical press. They look best when mounted on black velvet or paper. (*See No.* 6169.)

6172. To Stain Dried Grass. There are few prettier ornaments, and none more economical and lasting, than bouquets of dried grasses, mingled with the various unchangeable flowers. They have but one fault; and that is, the want of other colors besides yellow and drab or brown. To vary their shade, artificially, these flowers are sometimes dyed green. This, however, is in bad taste, and unnatural. The best effect is produced by blending rose and red tints, together with a very little pale blue, with the grasses and flowers, as they dry naturally. The best means of dyeing dried leaves, flowers, and grasses, is to dip them into the spirituous liquid solution of the various compounds of analine. (*See Nos.* 2552, *&c.*) Some of these have a beautiful rose shade; others red, blue, orange, and purple. The depth of color can be regulated by diluting, if necessary, the original dyes, with spirit, down to the shade desired. When taken out of the dye they should be exposed to the air to dry off the spirit. They then require arranging, or setting into form, as, when wet, the petals and fine filaments have a tendency to cling together. A pink saucer, as sold by most druggists, will supply enough rose dye for two ordinary bouquets. The pink saucer yields the best rose dye by washing it off with water and lemon juice. The analine dyes yield the best violet, mauve, and purple colors.

6173. Artificial Coral. Melt together yellow resin, 4 parts; vermilion, 1 part. This gives a very pretty effect to glass, twigs, raisin stalks, cinders, stones, &c., dipped into the mixture and dried.

6174. To Copy Ferns. Dip them well in common porter, and then lay them flat between white sheets of paper, with slight pressure, and let them dry out.

6175. To Preserve Natural Flowers. Dip the flowers in melted paraffine, withdrawing them quickly. The liquid should be only just hot enough to maintain its fluidity, and the flowers should be dipped one at a time, held by the stalks and moved about for an instant to get rid of air bubbles. Fresh-cut flowers, free from moisture, make excellent specimens in this way.

6176. To Collect and Preserve Specimens of Plants. To form what is called the *hortus siccus*, or *herbarium*, various methods are employed, but the following is recommended as the most simple. The articles requisite for the purpose consist of a dozen quires of smooth soft paper of a large size, 6 boards of about an inch in thickness, and 4 iron or lead weights, two of them about 30 pounds, and the two others about half that weight, and a botanical box of tin, and of such dimensions as shall be most convenient for the collector. The plants to be preserved ought, if possible, to be gathered in dry weather; but if the weather be wet they should be laid out for some time on a table till partially dried, and when the roots are taken up along with the stems, they must be washed and then exposed to the air for the same purpose.

6177. To Preserve Plants. Lay over one of the boards two or three sheets of the paper described in the last receipt. On the uppermost sheet spread out the specimen to be preserved, unfolding its parts so as to give it as natural an appearance as possible, laying out the leaves and flowers with particular care. Over the specimen thus disposed of place several sheets of paper; on the uppermost sheet spread out another specimen, and so proceed till all the plants intended to be preserved are laid down; and having put over the whole some more sheets of paper, place a board over them with the weights upon it, which may be a number of clean bricks, if iron or lead weights cannot conveniently be procured. As some plants are delicate and flexible, and others comparatively thick and hard, the former class will require less weight to be placed over them, and the latter considerably more.

6178. To Preserve the Color and Shape of Plants when Drying. To preserve the color of flowers when drying, the greatest care is required in changing the papers every second day, which papers ought first to be well dried at the fire. With regard to keeping the shape of flowers, the utmost care and attention is necessary when arranging them on the paper; this can be done by having another piece of paper and gently laying it on part of the flower; the part of the flower so covered with the paper ought to have a small book placed on it. Then begin and lay out the other leaves of the flower, and also press it, and so on, until each part has had the gentle pressure necessary to keep it in position. Let them remain so for a short time, and then put some heavy weight on them; look at them next day, and change the damp paper. Ferns may be kept for years quite fresh in color by this simple mode of drying. In 3 or 4 days the plants thus treated should be taken out, together with the paper in which they have been deposited, and laid in fresh paper with 3 or 4 sheets between every 2 plants, and the board and weights laid upon them as before. This process must be continued till the plants are perfectly dried. Each specimen is then to be placed on a sheet of dry paper, along with a memorandum of the name of the plant, the place and time at which it was gathered, the character of the soil from which it was taken, and any other particulars tending to illustrate its character and history.

6179. To Mount Small Insects for the Microscope. Mounting small insects for the microscope, such as parasites and acari from birds, beetles, &c., may be performed by placing the live insect on the inside of a sheet of tolerable good note paper, folded, and when in the act of running, closing the paper and pressing it tightly in a book. By this means the legs and antennæ may be nicely extended, all the expressed moisture absorbed by the paper, and the skin left apparently unbroken. It should be allowed to remain in the book about 2 days, when it may be carefully removed from the paper, put in a turpentine bath, and afterwards mounted in balsam in the usual way. (*See No.* 6180.)

6180. To Mount Microscopic Objects in Canada Balsam. Warm the glass slips, &c., to a temperature just below the boiling heat of water. If there is any doubt of the balsam penetrating all the interstices and readily adhering to the specimens, it will be well to pour a few drops of clear turpentine upon the specimens, which will greatly facilitate the taking of the balsam; the latter, however, must not be used until the turpentine has nearly evaporated. The moment when the balsam is to be added with the best effect can only be known by experience. Clear old Canada balsam is the best suited for these purposes. When used it must also be heated to a temperature just below boiling water, and then poured upon the object, previously arranged upon a slip of glass. The top slip of glass, which is usually smaller and thinner than the under one, is now to be placed upon it; one end of each slip being brought into contact first, and then the other allowed to fall upon it. By this means no air-bubbles will be enclosed. The exact quantity of balsam must be learned by practice. Of two faults, namely, too much or too little, the former is to be preferred. Be careful not to press the glasses together too hard, otherwise, on the removal of the pressure, the air will enter between the glasses, and the preparation will be spoilt. Having thus mounted the object, it must be slowly dried in a warm situation. This will take 1 or 2 days; after which the slide is to be cleaned by scraping off the surplus balsam with a strip of plate glass. Finally, wipe it clean, using first a linen rag moistened with turpentine, and then a piece of dry clean leather.

6181. Marvels of the Microscope. A beautiful and easily produced exhibition of crystal formation may be seen under the microscope as follows: Upon a slip of glass, place a drop of liquid chloride of gold or nitrate of silver, with a particle of zinc in the gold and copper in the silver. A growth of exquisite gold or silver ferns will vegetate under the observer's delighted eye.

6182. To Prepare a Skeleton. After cutting off as much flesh and cartilage from the bones as possible, boil them in water till the remainder easily separates. The French still further prepare their skeletons by bleaching for a short time in a weak solution of chloride of lime.

6183. Phial Barometer. Take a common phial and cut off the rim and part of the neck with a file. This may also be effected by means of a piece of cord passed round it, and moved rapidly to and fro, in a sawing direction; the one end being held in the left hand and the other fastened to any convenient object, while the right hand holds and moves the phial; when heated, dip it suddenly into cold water, and the part will crack off. (*See Nos.* 2368, *&c.*) Then nearly fill the phial with clean water, place your finger on the mouth, and invert it; withdraw your finger, and suspend it in this position with a piece of wire or twine. In dry weather the under surface of the water will be level with the neck of the bottle, or even concave; in damp weather, on the contrary, a drop will appear at the mouth and continue until it falls, and is then followed by another in the same way.

6184. The Chemical Barometer, or Storm Glass. Take a long narrow bottle, such as an old-fashioned eau-de-Cologne bottle, and put into it 2½ drachms of camphor and 11 drachms of spirit of wine; when the camphor is dissolved, which it will readily do by slight agitation, add the following mixture: Take water, 9 drachms; nitrate of potassa (saltpetre), 38 grains; and muriate of ammonia (sal ammoniac), 38 grains. Dissolve these salts in the water before mixing with the camphorated spirit; then shake the whole well together. Cork the bottle well, and wax the top, but afterwards make a very small aperture in the cork with a red-hot needle. The bottle may then be hung up, or placed in any stationary position. By observing the different appearances which the materials assume as the weather changes, it becomes an excellent prognosticator of a coming storm or of a sunny sky.

6185. To Teach a Parrot to Speak. The quickest way is to send the bird, if possible, where there is another parrot who can speak. They should be placed near enough to hear, but not see each other, and the one will soon imitate the other. A good way is to speak to the bird at night; just when his cage has been covered over (which must always be done with a woolen rug in winter) repeat over several times in the same tone the sentence you wish him to learn. He may not appear to notice at first, but some day, quite unexpectedly, he will repeat the sentence exactly in the same tone that he has heard it. He should at once be rewarded with a bit of sugar, or fruit, or any little dainty that he is fond of. They are very quick at understanding that rewards are given for obedience. Never allow a parrot to be startled or teased, or permit it to be fed indiscriminately by visitors. Keep the cage extremely clean; let it be wiped out and fresh sand given every day. Some birds drink very little, but they should always be able to get a drink of fresh water if they wish. It is also a good plan to let a small quantity of canary seed be in the seed-can; it is possible that the morning bread and milk may be forgotten, and the seed will thus prevent the bird being starved.

6186. Etching Shells. This is done by means of acid. The parts not to be acted upon must be protected by a so-called etching-ground, which consists of a thin layer of varnish blackened in a flame so as to see plainly the figures afterward drawn on it. Be careful, when doing this, to make a clear drawing or writing in which the shell is exposed at the bottom of every line, as any remaining varnish would protect those parts, and the writing would not be brought out. The acid, either strong acetic, diluted nitric, or muriatic, is then applied, and when its action is sufficient it is washed off with water, the varnish is rubbed off with turpentine or alcohol, when the drawing or lettering will appear, and look as if cut in with an engraver's tool. The design may also be drawn with varnish on the shell by means of a fine brush, then the acid will dissolve the surface around the lines drawn, and the writing will appear in relief, the letters being elevated in place of being sunk in as by the former process. The latter is the more common way in which these shells are treated. This method is applied to many other objects; all that is wanted being a liquid dissolving the material to be acted upon, and a varnish to protect some parts from its action.

6187. To Clean Shells. Make lye by boiling strong ashes, allow it to settle; pour the lye over the shells, and boil them 6 or 7 hours, or longer if they are large; then soak, and wash often in fresh water.

6188. To Color Shells. Dissolve a little lac dye in a solution of chloride of tin; and having made the shells thoroughly clean, dip them in this preparation until they are of the desired color. The dye should be first boiled, and then allowed to stand to settle.

6189. To Keep Gold-Fish. Gold-fish must be kept in a vessel of sufficient capacity, and be given fresh water every day, or at least every other day. It is best to clean the vessel then, by washing it inside with a cloth. The fresh water ought to be clean, and not too hard. It is not good to feed them, as the food will only serve to render the water unfit for their existence, and if renewed every day, the water itself furnishes them with enough material for their sustenance. Fish kept in this way generally perish from want of oxygen. Anything, therefore, which consumes it ought to be avoided, and this is a reason for not giving them any food. Green leaves of living plants have an opposite effect, and they may be kept for this purpose in fish-bowls; they absorb the carbonic acid in the water exhaled by the fish, giving off oxygen, which is in turn taken up by the fish and reconverted into carbonic acid.

6190. Food for Mocking-Birds. Mix together 2 parts corn-meal, 2 parts pea-meal, and 1 part moss-meal; add a little melted lard, but not sufficient to make the mixture too greasy, and sweeten with molasses. Fry in a frying-pan for ½ hour, stirring constantly, and taking care not to let it burn; this makes it keep well. Put it in a covered jar. The *moss-meal* is prepared by drying and grinding the imported German moss-seed.

6191. German Paste for Feeding Singing-Birds. Blanched sweet almonds, 1 pound; pea-meal, 2 pounds; butter, 3 ounces; saffron, a few grains; honey, a sufficient quantity. Form the whole into a paste, and granulate it by pressing it through a cullender. Some add the yolks of 2 eggs.

6192. How to See Under Water. The Indians of North America do this by cutting a hole through the ice, and then covering or hanging a blanket, in such a manner as to darken or exclude the direct rays of the sun, when they are enabled to see into the water, and discover fish at any reasonable depth. Let any one who is anxious to prove this, place himself under the blanket, and he will be astonished when he beholds with what a brilliancy everything in the fluid world is lighted up. A correspondent of the Scientific American says: "I once had occasion to examine the bottom of a mill pond, for which I constructed a float out of inch boards, sufficient to buoy me up; through the centre of this float I cut a hole, and placed a blanket over it, when I was enabled to clearly discover objects on the bottom, and several lost tools were discovered and picked up. I am satisfied that, where water is sufficiently clear, this latter plan could be successfully used for searching for lost bodies and articles."

6193. To Prepare Soap for Bubbles. Dissolve castile soap in strong alcohol; let it settle, or filter, and take the clear solution, from which evaporate the alcohol. The solid residue is oleate of soda. To this add half its weight of glycerine and sufficient water to give the proper consistency. The beauty of the experiments will compensate for all the trouble.

6194. To Produce Large and Long-lasting Soap-Bubbles. For the production of unusually large soap-bubbles that will last for hours, and exhibit splendidly the beautiful colors of the rainbow, a fluid may be employed that can easily be prepared in the following way; Fine shavings of palm-oil soap are shaken in a large bottle with distilled water, until a concentrated solution of the soap is obtained; this is filtered through gray filtering paper, and then mixed with about one-third its bulk of pure glycerine. The fluid is to be shaken up before use. By means of a small glass funnel, of two inches diameter, connected with a tube of india-rubber, soap-bubbles may be prepared with this fluid, that will vie in beauty of color with the rainbow itself, and which may be kept for a long while by putting them carefully upon an iron ring which is slightly rusty and thoroughly wet with the soap solution. Bubbles of 1 foot and more in diameter will keep from 5 to 10 minutes; those of 2 or 3 inches in diameter will retain their form for 10 or 12 hours.

6195. To Transfer Ornaments for Carriages, Wagons, &c. This beautiful art is now practiced by many painters, for the sake of economy of time and labor. Decalcomine pictures expressly designed for carriages are now sold at the leading stationers' stores, and the amateur painter is enabled thereby to finish a job of carriage painting in fine style. These pictures may be stuck on, and the dampened paper carefully removed, leaving the picture intact upon the panel, requiring no touching with the pencil.

6196. To Apply Decalcomine Pictures. The proper way to put on decalcomine pictures is to varnish the picture carefully with the prepared varnish (which can be obtained with the pictures), with an ornamenting pencil, being sure not to get the varnish on the white paper. In a few minutes the picture will be ready to lay on the panel, and the paper can be removed by wetting it; and when thoroughly dry, it should be varnished like an oil painting. Be particular to purchase only those transfer pictures which are covered with gold leaf on the back, for they will show plainly on any colored surface, while the plain pictures are used only on white or light grounds. They may be procured at any stationery store, and the cost is trifling.

6197. Lead for Pencils. The easiest way of producing not only black lead, but all sorts of pencils, is by the following process, which combines simplicity, cheapness, and quality. Take white or pipe clay, put it into a tub of clear water, to soak for 12 hours, then agitate the whole until it resembles milk; let it rest 2 or 3 minutes, and pour off the supernatant milky liquor into a second vessel; then allow it to settle, pour off the clear water, and dry the residue on a filter. Then add black lead in any quantity. Powder it, and calcine it at a white heat in a loosely covered crucible; cool, and most carefully repulverize; then add prepared clay and prepared plumbago, equal parts. Make into a paste with water, and put into oiled moulds of the size required; dry very gradually, and apply sufficient heat to give the required degree of hardness—the pieces to be taken carefully from the moulds and placed in the grooves of the cedar. The more clay and heat employed, the harder the crayon; less clay and heat produce a contrary effect. The moulds must be made of 4 pieces of wood, nicely fitted together.

6198. Artificial Sea Water for Aquaria. A rough imitation of sea water is formed by mixing 100 ounces of fresh water with 3 ounces common salt, 1 ounce Epsom salts, 200 grains chloride of magnesium, and 40 grains chloride of potassium. Or, more precisely, the real constitution of sea-water may be imitated in the following manner: Mix with 970,000 grains rain water 27,000 of chloride of sodium, 3600 of chloride of magnesium, 750 of chloride of potassium, 29 of bromide of magnesium, 2300 of sulphate of magnesia, 1400 of sulphate of lime, 35 of carbonate of lime, 5 of iodide of sodium. These all being finely powdered and mixed first, are to be stirred into the water, through which a stream of air may be caused to pass from the bottom until the whole is dissolved. On no account is the water to be boiled, or even heated. Into this water, when clear, the rocks and sea-weed may be introduced. As soon as the latter are in a flourishing state, the animals may follow. Care must be taken not to have too many of these, and to remove immediately any that die. The loss by evaporation is to be made up by adding clean rain water. The aquarium, whether of fresh or of salt water, will require occasionally artificial aeration. This may be done by simply blowing through a glass tube which reaches to near the bottom, or, better still, in the following way: Take a glass syringe which can be easily worked. Having filled it with water, hold it with the nozzle about 2 inches from the surface of the water in the aquarium, into which the contents are to be discharged quickly, and with a sort of jerk. By this means a multitude of small bubbles are forced down into the fluid. This operation should be repeated for a considerable number of times.

6199. To Prevent Stair Carpets from Wearing. Stair carpets should always have a slip of paper put under them, at and over the edge of every stair, which is the part where they wear first, in order to lessen the friction of the carpet against the boards beneath. The strips should be within an inch or two as long as the carpet is wide and about 4 or 5 inches in breadth. A piece of old carpet answers better than paper if you have it. This plan will keep a stair carpet in good condition for a much longer time than without it.

6200. To Make an Æolian Harp. Of very thin cedar, pine, or other soft wood, make a box 5 or 6 inches deep, 7 or 8 inches wide, and of a length just equal to the width of the window in which it is to be placed. Across the top, near each end, glue a strip of wood ½ inch high and ¼ inch thick, for bridges. Into the ends of the box insert wooden pins, like those of a violin, to wind the strings around, two pins in each end. Make a sound-hole in the middle of the top, and string the box with small cat-gut, or blue violin strings. Fastening one end of each string to the wooden pin in one end of the box, and carrying it over the bridges, wind it around the turning-pin in the opposite end of the box. The ends of the box should be increased in thickness where the wooden pins enter, by a piece of wood glued upon the inside. Tune the strings in unison and place the box in the window. It is better to have 4 strings, as described, but a harp with a single string produces an exceedingly sweet melody of notes, which vary with the force of the wind.

6201. To Remove the Disagreeable Taste from New Wooden Vessels. First scald them with boiling water, then dissolve some pearlash or soda in lukewarm water, adding a little lime to it, and wash the inside of the vessel well with the solution. Afterwards scald it well with plain hot water before using.

6202. To Preserve Ribbons and Silks. Ribbons and other silks should be put away for preservation in brown paper; the chloride of lime used in manufacturing white paper frequently produces discoloration. A white satin dress should be pinned in blue paper, with brown paper outside, sewn together at the edges.

6203. To Make Feather Brushes. Boil the wing feathers of a turkey or chicken for 5 or 10 minutes, then rinse them in tepid water, dry them and tie them up in bunches to use in greasing pans and for brushing egg over tarts or pastry.

6204. Remedy for Frozen Potatoes. In time of frost, potatoes that have been affected thereby should be laid in a perfectly dark place for some days after the thaw has commenced. If thawed in open day they rot; but if in darkness, they do not rot; and they lose very little of their natural properties.

6205. To Make Fire Kindlers. Take a quart of tar and 3 pounds of resin, melt them, bring to a cooling temperature, mix with as much coarse sawdust, with a little charcoal added, as can be worked in; spread out while hot upon a board; when cold, break up into lumps of the size of a large hickory nut, and you have, at a small expense, kindling material enough for a household for one year. They will easily ignite from a match and burn with a strong blaze, long enough to start any wood that is fit to burn.

6206. To Loosen Ground Glass Stoppers. Sometimes the ground glass stoppers of bottles become, from one cause or another, fixed in the neck, and cannot be removed by pulling or twisting. An effectual method is to wrap a rag wet with hot water around the neck and let it remain a few seconds. The heat will expand the neck of the bottle, when the stopper can be removed before the heat penetrates the stopper itself. Or, wind a string once or twice around the neck, and, holding the bottle between the knees, pull alternately on one and the other end, thus creating friction, and consequently heat. Or a little camphene dropped between the neck and stopper of the bottle will often relieve the stopper.

6207. To Remove a Glass Stopper. The most effectual mode of removing stoppers, especially those of small bottles, such as smelling-bottles, is as follows: Take a piece of strong cord, about a yard or 4 feet in length, double it at the middle, and tie a knot (*Fig.* 1, *b*) so as to form a loop (*a*) of about 4 inches in length; at the doubled end, bring the knot close to one side of the stopper, and tie the ends tightly together on the opposite side, as at *Fig.* 2 (*e*) so as to fasten the string securely round the neck of the stopper; now pass one of the ends through the loop (*a*), and then tie it firmly to the other end; the doubled cord

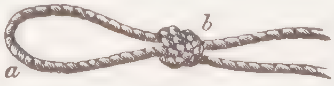


Fig. 1.

is then to be placed over a bar or other support, then if the bottle is surrounded by a cloth, to prevent accident in case of fracture, and pulled downwards with a jerk, the force of which is gradually increased, it will be found that in a short time the stopper is liberated. Two precautions are requisite—one is, that the strain on both sides of the stopper is equal; the other, that care be taken that when the stopper is liberated, it is not dashed by the rebound against any hard substance, which would cause its fracture.

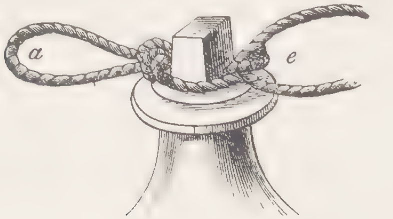


Fig. 2.

6208. To Keep Up Sash Windows. This is performed by means of cork, in the simplest manner, and with scarcely any expense. Bore 3 or 4 holes in the sides of the sash, into which insert common bottle-cork, projecting about the sixteenth part of an inch. These will press against the window frames along the usual groove, and by their elasticity support the sash at any height which may be required.

6209. How to Treat a Burning Chimney. If it is desired to extinguish the fire in a chimney which has been lighted by a fire in the fireplace, shut all the doors of the apartment so as to prevent any current of air up the chimney, then throw a few handfuls of common fine salt upon the fire in the grate or stove, which will immediately extinguish the fire in the chimney. The philosophy of this is, that in the process of burning the salt, muriatic acid gas is evolved, which is a prompt extinguisher of fire.

6210. To Prevent Glass from Cracking by Sudden Heating. Probably more articles of glass in daily use are broken by being suddenly heated than by blows or other acts of carelessness. Glass is a very poor conductor of heat, and when hot water is poured suddenly into a tumbler or goblet, it is almost certain to break unless the glass itself is quite warm. Tepid water should be first used, or a little cold water be poured into the glass on which the hot water may be drawn. Lamp chimneys frequently crack when placed upon the lighted lamp, especially if taken from a cold room. The proper remedy is to turn up the flame slowly or by degrees; this will gradually heat the glass, and prevent its fracture.

6211. To Restore the Color of Window Glass. Window glass constantly exposed to the action of the sun and rain soon deteriorates, as the potash or soda it contains combines with the carbonic acid of the air. A whitish opaqueness is the result of this action; and in order to restore the pane to its original clearness, rub it with dilute muriatic acid, and then clean with moistened whiting. It is said that glass in an extreme state of decomposition may be restored by this means..

6212. To Clean Discolored Glass. Glass that appears smoky may be cleaned by applying dilute nitric acid, when soap, turpentine, alcohol, or scouring with whiting would make no impression on it. Water of ammonia is also effective.

6213. To Remove a Ring from a Swollen Finger. A thread should be wound evenly around, beginning at the extremity of the finger, and bringing each coil close to the preceding, until the ring be reached. A needle is then threaded on and passed under the ring, and the thread is carefully unwound from the finger. The ring follows each coil as it is successively unrolled, and by almost imperceptible degrees is brought over the knuckle and removed. Care must be taken that the thread is wound on evenly, particularly over the swollen knuckle, or an entanglement will occur in the unwinding. A curved needle will pass under the ring more easily than a straight one.

6214. To Prevent Gas Meters from Freezing. Half a pint (or less) of *good* glycerine is said to prevent the freezing of a gallon of water, though at least double the proportion is preferable in the country, whatever the temperature in the winter may happen to be. Water containing about 40 per cent. of glycerine is but little inclined to freeze. Glycerine in a pure state is perfectly inert, and exercises no influence upon the metals of which the meter is composed. Whiskey, on the contrary, undergoes the acetous fermentation, by which the alcohol is converted into acetic acid, which corrodes the meter, and soon wears it out.

6215. To Prevent the Creaking of Doors. Apply a little soap to the hinges. Or: Take lard, soap, and black lead, equal parts, and apply.

6216. To Keep Kerosene Oil. This oil should be kept for use in air-tight closed vessels. A large quantity is best kept in a well-corked can provided with a faucet an inch or two from the bottom, so that the oil can be drawn off as required, without disturbing the sediment which usually collects on the bottom of the vessel; by this means the oil will be always clear and bright. The small cans used for filling lamps should be kept closely corked both at the neck and spout. If either cork be left out for a day or two, the oil will burn dull, and cake on the wick; this is more especially the case when the can is kept in a warm place.

6217. Management of Brooms. If brooms are wetted in boiling suds once a week, they will become very tough, will not cut a carpet, last much longer, and always sweep like a new broom.

6218. To Wash White Dogs. Make a good lather of white soap with a little spirit of turpentine; wash the dog as quickly as possible in this while it is warm, but not hot, taking care not to let the soap lather get into its eyes. Have a tub with clean tepid water in which a little blue has been dissolved ready; when the coat is clean dip the dog into the blue-water and rinse out the soap. Then rub it well in a clean sheet before a fire; if the hair is long comb it out and brush it as it dries. The turpentine will kill fleas unless the dog is much infested with them.

6219. To Paint an Iron Bath Tub. Mix the paint to a proper consistency with best coachmakers' Japan varnish. For white lead paint, use half turpentine and half coachmakers' Japan. It will not darken much. Venetian red is best for a first coat, for any color but white.

6220. To Raise Old Veneers. In repairing old cabinets, &c., workmen are often at a loss to know how to get rid of those blisters which appear on the surface. We will describe how the operation may be performed without difficulty. First wash the surface with boiling water, and with a coarse cloth remove dirt or grease; then place it before the fire; oil its surface with linseed oil, place it again to the fire, and the heat will make the oil penetrate quite through the veneer and soften the glue underneath; then, whilst hot, raise the edge gently with a chisel, and it will separate completely from the ground. Be careful not to use too much force, or you will spoil the work. If the work should get cold during the operation, apply more oil, and heat it again. When you have entirely separated the veneer, wash off the glue, and proceed to lay it again as a new veneer.

6221. To Take Bruises out of Furniture. Wet the part with warm water; double a piece of brown paper 5 or 6 times, soak it in warm water, and lay it on the place; apply on that a warm, but not hot, flat iron, till the moisture is evaporated. If the bruise be not gone, repeat the process. After two or three applications the dent or bruise will be raised to the surface. If the bruise be small, merely soak it with warm water, and hold a red-hot iron near the surface, keeping the surface continually wet; the bruise will soon disappear.

6222. To Dissolve Gum-Shellac in Ammonia. The vessel containing the shellac is put into a large vessel with hot water. Boiling water is then poured on the gum, after which ammonia is added slowly, but continuously, stirring all the while with a glass rod, until solution is effected. An excess of ammonia will color the solution brown. After cooling, the fluid is filtered, and may be kept in this state a long while.

6223. To Manage Water-Pipes in Winter. When the frost begins to set in, cover the water-pipes with hay or straw bands, twisted tight round them. Let the cisterns and water-butts be washed out occasionally; this will keep the water pure and fresh. In pumping up water into the cistern for the water-closet, be very particular in winter time. Let all the water be let out of the pipe when done; but if this is forgotten, and it should be frozen, take a small gimlet and bore a hole in the pipe, a little distance from the place where it is let off, which will prevent its bursting. Put a peg into the hole when the water is let off.

6224. To Protect Lead Water-Pipes. Dr. Schwarz, of Breslau, notes a simple method of protecting lead pipes from the action of water, by forming on the inside surface of the pipes an insoluble sulphide of lead. The operation, which is a very simple one, consists in filling the pipes with a warm and concentrated solution of sulphide of potassium or sodium; the solution is left in contact with the lead for about 15 minutes, and then poured out.

6225. Blowing Out Steam Boilers. Steam boilers should never be blown out under steam pressure. The safety valve should first be raised until the pressure is all removed by letting the steam escape as rapidly as possible; then the hand hole plate or other device should be opened, and the dirt and sediment will run out with the water. If the boiler is allowed to cool off, the dirt will settle to the bottom and be fastened on by the heat. The dirt is always on the top of the water when there is any pressure of steam on it.

6226. Substitute for a Corkscrew. A convenient substitute for a corkscrew, when the latter is not at hand, may be found in the use of a common screw, with an attached string to pull the cork. Or, stick two steel forks vertically into the cork on opposite sides, not too near the edge. Run the blade of a knife through the two, and give a twist.

6227. To Remove a Cork from the Inside of a Bottle. With a stout string projected into the bottle, turn the bottle around until the cork is caught in a loop of the string, and with force pull out the cork.

6228. To Remove Starch or Rust from Flat-Irons. To remove starch or rust from flat-irons, have a piece of yellow beeswax tied in a coarse cloth. When the iron is almost hot enough to use, but not quite, rub it quickly with the beeswax, and then with a clean, coarse cloth.

6229. To Prepare New Linen for Being Embroidered. New linen may be embroidered more easily by rubbing it over with fine white soap; it prevents the threads from cracking.

6230. To Shell Beans Easily. Pour upon the pods a quantity of scalding water and the beans will slip very easily from the pod. By pouring scalding water on apples, the skin may be easily slipped off, and much labor saved.

6231. To Improve the Wicks of Candles. First steep the wicks in a solution of lime-water in which saltpetre has been dissolved. To 1 gallon water add 2 ounces saltpetre and ½ pound lime. Dry well the wicks before using. It improves the light, and prevents the tallow from running.

6232. Adhesive for Leather Belts. Printers' ink is a good adhesive for leather belts. One application will keep a leather belt in running order for 12 months.

6233. Ajutage of Fountains. M. Francois, in his work, "Art des Fontaines," estimates the decrease in the height of the jet to be 1 foot below the level of the source for every 100 yards distance. He considers the ajutage or opening of the pipe should be ¼ of the size of the pipe itself. Where pipes are already laid down, and the power of the head not very accurately known, it is well, by means of a leaden nozzle, the orifice of which may be readily increased or diminished, to test the amount of force, so that the ajutage may be adapted to throw the highest and fullest jet the head is capable of.

6234. To Make Composition Ornaments for Picture Frames or Other Purposes. Mix as much whiting as you think will be required for present use with thinnish glue, to the consistence of putty; and having a mould ready, rub it well all over with sweet oil, and press your composition in it; take it out, and you will have a good impression, which you may set by to dry; or, if wanted, you may, before it gets hard, apply it to your work with thick glue, and bend it into the form required.

6235. To Stop Leaky Skylights. Leaky skylights may be stopped and cured with Dutch rushes, bedded in, caulked, and covered with good white lead. On wet making its appearance it quickly attacks the rush, which swells up so tight and firm that all progress of wet and droppings is effectually stayed.

6236. To Thicken and Strengthen Muslin. Dip the muslin in dilute sulphuric acid. According to Professor Calvert, of Manchester, England, this very much increases its thickness and strength. The cotton thus prepared is technically known as "blanket."

6237. To Develop the Inscription on Worn Coins. By heating these gradually, the inscription will, in almost all cases, make its appearance.

6238. To Preserve Copper Coins and Medals from the Action of the Air. Immerse them for a moment in melted paraffine, and then wipe off the excess of paraffine with a clean dry cloth.

6239. To Prepare Bladders. These articles are prepared by cutting off the fat and loose membranes attached to them, and washing them first in a weak solution of chloride of lime, and afterwards in clear water; they are then blown out and submitted to pressure by rolling them under the arm, by which they become considerably larger; they are next blown quite tight, dried, and tied up in dozens for sale. Or, dip them in warm water, dry and rub them well in with a little glycerine; they will keep soft and pliable. They are employed by druggists and oil and colormen to tie over pots, bottles, and jars, and to contain pill masses, and other similar substances. Never buy bladders unless they are perfectly dry and tight, as, if the reverse be the case, they will neither keep nor prove sound.

6240. To Obtain Herbs of the Finest Flavor. When herbs are to be kept for flavoring dishes, it is obviously of the first importance that they should be gathered at the right time, and dried in the best manner. The seasons when the various herbs have in their fullest flavor, are as follows: Basil, from the middle of August to the middle of September; marjoram, during the month of July; winter savory, the latter end of July and throughout August; summer savory, the same; thyme, of various kinds, during June and July; mint, the latter end of June, and during July; sage, August and September; tarragon and burnet, June, July, and August; chervil, parsley, fennel, elder flowers, and orange flowers, May, June, and July. As the seasons vary in different localities, a good general rule is to gather the herbs when they first blossom. Herbs should be gathered on a dry day, before the sun has been long upon them. When intended for preservation, they should be cleaned from dirt and dust, and dried gradually upon a warm stove, or in a Dutch oven, after which they may be tied up in bags made of old newspaper. Or, the leaves may be picked off, pounded in a mortar, passed through a hair sieve, and the powders be preserved separately in well-stoppered bottles.

6241. To Remove Clinker from Fire Brick. When the fire bricks have become covered with clinkers which have fused and adhered, they may be cleaned by throwing oyster or clam shells into the fire box when the fire is very hot, and allowing the fire to go out. The clinkers will generally cleave off without the use of much force the next morning. From 2 quarts to ½ peck will be sufficient for most stoves, and the operation can be repeated if some of the clinkers still adhere. Salt sprinkled on clinker adhering to fire brick will also loosen it.

6242. To Preserve Carpets. It is very advisable in laying down carpets at first, to cover the floor beneath them with large sheets of paper, so as to prevent the dust from rising between the boards. A carpet lasts longer by adopting this precaution.

6243. To Prevent Injury to Kid Gloves from Excessive Perspiration. Persons who wear kid gloves in hot weather, and who perspire freely, will find that injury to the gloves will be prevented by applying ordinary corn starch to their hands (dry) before drawing on their gloves. Pulverized soap-stone will answer the same purpose.

6244. The Art of Easy Shaving. The following is the substance of the instructions of the celebrated Mr. Mechi on this subject: Never fail to well wash your beard with soap and cold water, and to rub it dry, immediately before you apply the lather, of which the more you use, and the thicker it is, the easier you will shave. Never use warm water, which makes a tender face. In cold weather, place your razor (closed of course) in your pocket, or under your arm, to warm it. The moment you leave your bed (or bath) is the best time to shave. Always wipe your razor clean, and strop it before putting it away; and put your shaving-brush away with the lather on it. The razor (being only a very fine saw) should be moved in a sloping or sawing direction, and held nearly flat to your face, care being taken to draw the skin as tight as possible with the left hand, so as to present an even surface, and to throw out the beard.

6245. To Hone a Razor. The surface of the hone must be perfectly level. The razor should be held flat on the hone, and the back never raised, or it will induce a round or thick edge. Draw the razor from heel to point, alternating the sides at each stroke, and the action always against the edge. When the edge is wiry and thin enough to turn, strop it on a coarse strop, drawing the edge occasionally over the thumb nail, until the edge is smooth, then finish on a fine strop, and the palm of the hand.

6246. Strop for Razors. There are many kinds of razor strops formed of leather glued on a wooden holder. These are apt, in time, to round the edge of the razor, by allowing the blade to bed itself or sink in the leather. The best is a strip of Russia leather, strained as tight as a drum on a curved or bowed piece of wood.

6247. Paste for Razors. Emery very finely levigated (washed) in the same manner as prepared chalk (*see No.* 1292), mixed with lard or tallow, or a mixture of these with neat's-foot oil. Or: equal parts of jewelers' rouge, black lead, and prepared suet.

6248. Pradier's Paste for Razors. Best putty powder, 1 ounce; jewelers' rouge, 1 ounce; scales of iron, ½ ounce; levigated Turkey stone, 3 ounces; beef suet, 1½ ounces. Or: Mix equal parts of dried sulphate of iron and salt, and apply a gradually increased heat, in a closed vessel. Pulverize, elutriate (*see No.* 14), and mix with lard or tallow.

6249. To Strop a Razor. The practice of pressing on the edge of a razor in stropping soon rounds it; the pressure should be directed to the back, which should never be raised from the strop. If you shave from heel to point of the razor, strop it from point to heel; but if you begin with the point in shaving, then strop it from heel to point. If you only once put away your razor without stropping it, or otherwise perfectly cleaning the edge, you must no longer expect to shave well and easy, the soap and damp so soon rust the fine edge. A piece of soft plate-leather (chamois leather) should always be kept with razors, to wipe them with.

6250. To Sharpen a Razor. The simplest method of sharpening a razor is to put it for half an hour in water to which has been added $\frac{1}{20}$ of its weight of muriatic or sulphuric acid, and after a few hours set it on a hone. The acid acts as a whetstone, by corroding the whole surface uniformly, so that nothing further than a smooth polish is necessary.

6251. To Sharpen Edge Tools. Proceed as directed in the last receipt.

6252. To Grind Cutlery and Edge Tools. For grinding, the stone should be dipped in water to prevent the heating of the tools; and careful cutlers use oil for polishing, instead of water, when using grindstones of small diameter.

6253. Caution in Grinding Cutlery. Never follow the example of the street knife-grinder. He does much work, and cheap work. He uses as little water as possible. Give him a good razor or a good knife, and he gives it back well sharpened, but a spoiled tool, which needs to be hardened anew. Therefore, when sharpening tools, take large stones with much water, and make slow and good work.

6254. To Sharpen and Set a Saw. First, run a file along the edge of the teeth till you see them range in a direct line; then lay the blade on a smooth piece of lead, or on the end of a trying-plane, and with a square steel punch and a hammer, give a gentle tap on every alternate tooth. Reverse the saw and punch the alternate teeth on the other side, and look down the saw to see that the teeth are all equally set. Then begin with your file at that part of the saw nearest the handle. To sharpen or file the teeth to a good point, hold the file so that it makes an angle with the saw-blade of about 30 degrees, or ⅔ that of a mitre angle. Then file every other tooth to a very sharp point, sharpening only those teeth which are *set away* from the operator. Turn the saw round, and repeat the operation on the remaining teeth. The file used for sharpening saws should be triangular, and in fine order. A dull file will never make a sharp saw.

6255. To File a Flat Surface. In filing a flat surface on a piece of iron, unless there is some skill or care used in the operation, the exterior edges are apt to be greatly pared away, so that that part of the surface about midway between them will be the least filed down. The work should be held in a bench vise, in such a position that the file will run in a horizontal direction nearly level with the workman's elbow; but should the work be of a very light nature, it may be held in a more elevated position; or, if it be very heavy, it may be held a little lower. In filing flat surfaces, a 'surface-plate' is used, to enable the operator to finish the work with accuracy. The surface-plate is a cast-iron plate planed and carefully reduced to a true surface. Some red lead is rubbed on this plate before being used; then this piece of work is rubbed on the plate, and wherever the work is reddened it shows that that part of the work is above the level, and has to be filed down; and this process of testing and filing is carried on until the work is reduced to a perfectly true surface. It saves the file to draw it back at each stroke as lightly as possible. There is also economy in using the files first on brass or cast iron, and afterwards on wrought iron.

6256. Recutting Files with Acids. There are many receipts for converting old files into new by means of acids, and among the latest is that recently patented by Albert I. Ferguson, of Sharon, Pa. The files must be thoroughly cleansed in warm water containing a small quantity of potash, which readily removes any grease or dirt from them. After the files are thus cleansed, they must be washed with warm water and dried by artificial heat. Next, place 1 pint warm water into a wooden vessel, and put into it as many files as the water will cover. Then add 2 ounces blue vitriol (sulphate of copper) finely pulverized, and 2 ounces borax, well mixed, taking care to turn the files over, so that each may come in contact with the mixture. To the above mixture now add 7 ounces sulphuric acid and ¼ ounce cider vinegar, which will cause the files to assume a red appearance at first, but they will in a short time resume their natural color. Then they must be removed, washed in cold water, and dried by artificial heat. When dry, they must be sponged with olive oil, wrapped in porous paper, and laid aside for use.

6257. Re-Sharpening Files. A very interesting and economical process has been exhibited before the Société d'Encouragement of Paris, by M. Werdermann. Well-worn files are first carefully cleaned by means of hot water and soda; they are then placed in connection with the positive pole of a battery, in a bath composed of 40 parts sulphuric acid, 80 parts nitric acid, and 1000 parts water. The negative pole is formed of a copper spiral surrounding the files, but not touching them; the coil terminates in a wire which rises towards the surface. This arrangement is the result of practical experience. When the files have been 10 minutes in the bath they are taken out, washed, and dried, when the whole of the hollows will be found to have been attacked in a very sensible manner; but should the effect not be sufficient, they are replaced for the same period as before. Two operations are sometimes necessary, but rarely more. The files thus acted upon are, to all appearance, like new ones, and are said to be good for sixty hours' work.

6258. To Clean Files. The occasional cleaning of files in the machine shop by means of oil, heat, and the card (wire brush) will save dollars to the owner and annoyance to the worker.

6259. To Cut Good Steel Scrapers. Part of the blade of a broken saw makes the best scrapers; but, as it is hard, it is very difficult to cut it into the required form. The best and most expeditious way is to mark it out to the size wanted, and then to place the blade or steel plate in a vise which shuts very close, placing the mark even with the face of the vise, and the part to be cut to waste above the vise. Then with a cold-chisel, holding it close to the vise and rather inclined upwards, begin at one end of the steel plate, and with a sharp blow of the hammer it will cut it. Keep going on by degrees, and it will with ease be cut to the shape required; then grind the edges of the scraper level, and finish by rubbing it on a Turkey-stone.

6260. Knots. It is not a very difficult thing to tie a neat and secure knot, yet comparatively few persons know how to accomplish it. Below we give all the knots necessary for ordinary purposes, with illustrations and directions for making them.

6261. The Sheet Bend or Weaver's Knot. This knot is usually employed by netters, and is called by sailors "the sheet bend." It is readily made by bending one of the pieces of cord into a loop (*a*, *b*, *Fig.* 1), which is to be held between the finger and thumb of the left hand; the other cord, *c*, is passed through the loop from the further side, then round behind the two legs of the loop, and lastly under itself, the loose end coming out at *d*. In the smallness of its size, and the firmness with which the various parts grip together, this knot surpasses every other; it can, moreover, be tied readily when one of the pieces, viz., *a*, *b*, is exceedingly short; in common stout twine, less than an inch being sufficient to form the loop. The above method of forming it is the simplest to describe, although not the most rapid in practice; as it may be made in much less time by crossing the two ends of cord (*a*, *b*, *Fig.* 2) on the tip of the forefinger of the left hand, and holding them firmly by the left thumb, which covers the crossing; then the part *c* is to be wound round the thumb in a loop, as shown in the figure, and passed between the two ends, behind *a* and before *b*; the knot is completed by turning the end *b* downwards in front of *d*, passing it through the loop, securing it under the left thumb, and tightening the whole by pulling *d*. As formed in this mode, it is more rapidly made than almost any other knot; and, as before stated, it excels all in security and compactness; so firmly do the various turns grip each other, that, after having been tightly pulled, it is very difficult to untie; this is the only drawback to its usefulness, and in this respect it is inferior to the reef-knot, *Fig.* 3, which is made in precisely the same manner that a shoe-string is tied, only pulling out the ends instead of leaving them as bows.

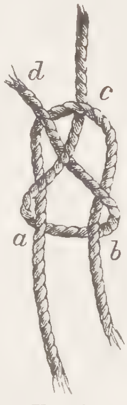


Fig. 1.

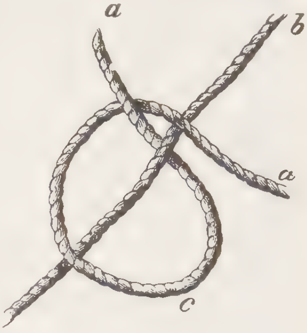


Fig. 2.

6262. The Reef Knot. The only precaution necessary in making a reef-knot is to observe that the two parts of each string are on the same side of the loop; if they are not, the ends (and the bows, if any are formed) are at right angles to the cords. The knot is less secure than the weaver's knot, and is termed by sailors a granny-knot. Other knots are occasionally used to connect two cords, but it is unnecessary to describe them, as every useful purpose may be answered by those above mentioned.

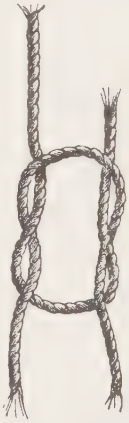


Fig 3.

6263. The Binding Knot. The binding knot, (*Figs.* 4, 5,) is exceedingly useful in connecting broken sticks, rods, &c., but some difficulty is often experienced in fastening it at the finish; if, however the string is placed over the part to be united, as shown in *Fig.* 4, and the long end *b*, used to bind around the rod, and finally passed through the loop *a*, as shown in *Fig.* 5, it is readily secured by pulling *d*, when the loop is drawn in, and fastens the end of the cord.

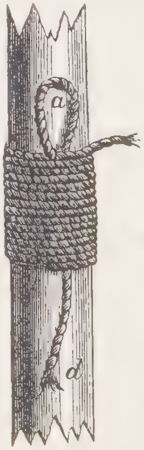


Fig. 5

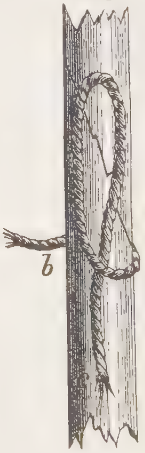


Fig. 4.

6264. The Double Half Hitch or Clove Hitch. For fastening a cord to any cylindrical object, one of the most useful knots is the clove hitch, which, although exceedingly simple and most easily made, is one of the most puzzling knots to the uninitiated. There are several modes of forming it, the most simple being perhaps as follows: make two loops, precisely similar in every respect, as *a* and *b*, *Fig.* 6, then bring *b* in front of *a*, so as to make both loops correspond, and pass them over the object to be tied, tightening the ends; if this is properly done, the knot will not slip, although surrounding a tolerably smooth cylindrical object, as a pillar, pole, &c. This knot is employed by surgeons in reducing dislocations of the last joint of the thumb, and by sailors in great part of the standing rigging. The loop which is formed when a cable is passed around a post or tree to secure a vessel near shore, is fastened by what sailors term two half hitches, which is simply a clove hitch made by the end of the rope which is passed around the post or tree, and then made to describe the clove hitch around that part of itself which is tightly strained. (*See Fig.* 7.)

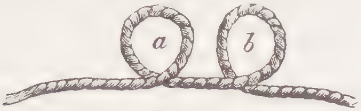


Fig. 6.

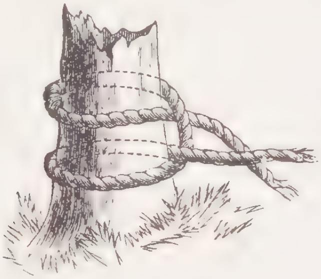


Fig. 7.

6265. The Bowline. This knot is used in slinging heavy bodies; it cannot slip, and will never jam under the heaviest strain. It is difficult to understand at first, but with a little practice can be made very rapidly. Take the fixed or standing part of the rope in the left hand (this should be done in making all knots), lay the free end over it, and then by a twist of the wrist make a loop in the standing part which shall inclose the free end (*a, Fig.* 8); then carry the free end behind the standing part and through the loop, parallel with itself (*b, Fig.* 8). This knot will well repay the trouble spent in learning it.

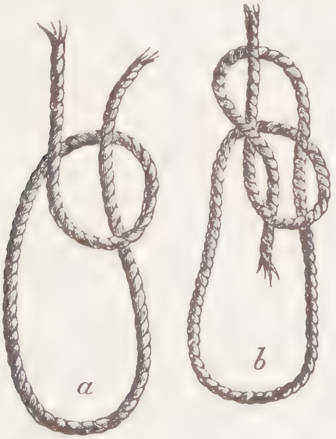


Fig. 8.

6266. How to Tie a Parcel. The tying up of parcels in paper is an operation which is seldom neatly performed by persons whose occupations have not given them great facilities for constant practice. Let a single knot be made in the end of the cord, which is then passed around the box or parcel. This knotted end is now tied by a single hitch around the middle of the cord (*Fig.* 9) and the whole pulled tight. The cord itself is then carried at right angles round the end of the parcel, and where it crosses the transverse cord on the bottom of the box (*Fig.* 10) it should, if the parcel is heavy and requires to be firmly secured, be passed over the cross cord, then back underneath it, and pulled tightly, then over itself; lastly, under the cross cord, and on around the other end of the box. When it reaches the top it must be secured by passing it under that part of the cord which runs lengthways (*a, Fig.* 9), pulling it very tight, and fastening it by two half hitches round itself. The great cause of parcels becoming loose is the fact of the cord being often fastened to one of the transverse parts (as *b, Fig.* 9), instead of the piece running lengthways, and in this case it invariably becomes loose. The description may perhaps be rendered clearer by the aid of the figures, which exhibit the top and bottom of a box corded as described. The cords, however, are shown in a loose state, to allow their arrangement to be perceived more easily.

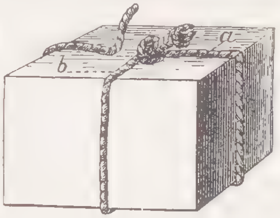


Fig. 9.

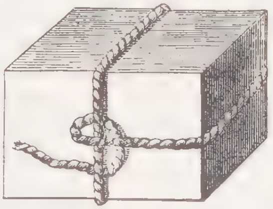


Fig. 10.

6267. Artificial Grindstones. Washed silicious sand, 3 parts; shellac, 1 part; melt, and form it into the proper shape while warm. The fineness of the sand must depend on the work the stone is intended for. Powdered emery may be substituted for sand. The same composition is formed upon pieces of wood, for the purpose of sharpening knives, and cutting stones, shells, &c.

6268. To Make an Emery Wheel for Grinding Tools. Provide a solid wheel, made of pine, or any other soft wood, and of the size required for the purpose. Turn the wheel true, and then turn rounds or hollows in its face, to suit the tools you wish to grind, gouges, rounds, &c. Then prepare some best glue, and, using it hot and thin, put it on the face of the wheel with a brush. The first coat of glue should be a light one, and when it is dry a second one should be applied, and, as quickly as possible, as much emery should be sifted upon the wet surface as the glue will hold. When this is dry another coat of glue and emery should be applied in the same way. This will make a wheel that will last for months, and grind faster than anything else. No. 0 emery is best for this purpose. (*See last receipt.*)

6269. To Cement Emery to Wood. The following cement is wonderfully tough. Melt together equal parts of shellac, white resin, and carbolic acid in crystals; add the last after the others are melted. The effect of the carbolic acid is surprising.

6270. Kerosene Oil for Whetstones. Kerosene oil on whetstones is superior to any other liquid for the purpose, as it keeps the stone in better condition and assists the operation of sharpening.

6271. How to Use a Grindstone. Do not waste the stone by running it in water; but if you do, do not allow it to stand in water when not in use, as this will cause a soft place; it is much better to wet the stone by dropping water on it from a pot suspended above the stone, and stop off the water when not in use. Do not allow the stone to get out of order, but keep it perfectly round by use of gas pipe, or a hacker. Clean off all greasy tools before sharpening, as grease or oil destroys the grit. Observe: when you get a stone that suits your purpose, send a sample of the grit to the dealer to select by; a half ounce sample is enough, and can be sent in a letter by mail.

6272. Soap in Place of Oil on Arkansas Stones. The employment of oil for the purpose of keeping Arkansas and other stones in proper condition for sharpening instruments is so general as to be almost, if not entirely, to the exclusion of every other substance. The tendency, however, to become gummy, and clog the surface of the stone after it has been on a short time, and the liability of soiling the fingers and imparting an unpleasant odor to them, make the use of oil objectionable. All this can be readily obviated, however, by using soap in place of oil, as follows:—Rub a piece of toilet soap and a little water over the surface of the stone until a thick lather is formed, and then allow this to dry. When occasion arises for putting an edge on a tool, a few drops of water will moisten the soap and place the stone in proper condition for use at once. This plan is one that has been successfully employed for years.

6273. Drill Lubricator. In drilling wrought iron, use 1 pound soft soap, mixed with 1 gallon boiling water. This is a cheap lubricator; it insures working with great ease, and clean cutting by the drill.

6274. To Face Oil Stones. Take a piece of iron with even or straight face (it ought to be planed); scatter a little emery or fine sand about as coarse as No. 1½ sand paper on the iron plate, add a little water and rub the face of the stone, renewing the emery or sand and water as requisite, finishing with an adition of water without emery or sand. This is the quickest and truest way, making the stone perfectly straight and occupying from 5 to 10 minutes time.

6275. To Make Plain Chocolate. Roasted cocoa or chocolate beans or nuts are made into paste by trituration in a heated mortar; then poured into tin moulds and left till cold. In this form it is cake chocolate. By grinding this is reduced to chocolate powder. Sweetened and flavored chocolate is made in this way: the sugar and aromatics being added during the trituration; the proportions of these used for the various kinds of chocolate are given below. Vanilla, &c., must be ground before adding to the paste. (*See No.* 6279.)

6276. French Chocolate. Grind together as in last receipt, 3 pounds best cacao nuts, 1 pound refined sugar, and 2 vanilla beans. (*See No.* 6279.)

6277. Spanish Aromatic Chocolate. Grind together 11 pounds Caracca nuts, 3 pounds white sugar, 1 ounce vanilla, ¼ ounce cinnamon, and ½ drachm cloves. (*See No.* 6279.)

6278. Spanish Almond and Vanilla Chocolate. Take 10 pounds Caracca nuts and 3 pounds sugar (or 8 pounds Caracca nuts and 2 pounds island cacao and 10 pounds sugar), and 3 ounces vanilla. Prepare as in the last receipt.

6279. To Grind Vanilla Beans. Vanilla is pulverized by triturating with a little sugar.

6280. Molasses Candy. Take 1 quart molasses, 1½ pounds brown sugar, the juice of a large lemon and 12 drops oil of lemon; mix the molasses and sugar together, butter the inside of a kettle and put it in. Let it boil over a moderate fire for 2 hours, then add the lemon juice and boil ½ hour; stir it often, to prevent it from burning; when thoroughly done it will cease boiling; then butter a pan and put it in to cool; if sufficiently done it will be crisp and brittle, if not it will be tough and ropy. Nuts of any kind may be added just before it is put in the pan; they must be well stirred in. The candy may be worked by keeping the hands well covered with flour, or by greasing them well with butter. The working must be done as soon as it is cool enough to handle. It may be made of molasses only—in this case it requires longer boiling—and other flavoring may be used instead of lemon.

6281. To Make Taffee. Mix ¾ cup butter with 2 of sugar, and, when well stirred together, put it in a china lined saucepan over the fire. Let it boil steadily and gently until, by dropping a little on a plate and cooling it, you find it sufficiently stiff.

6282. To Make Molasses Taffee. To 1 quart of molasses put 1 gill of cold water, and set it over a moderate fire; let it boil steadily until nearly stiff enough, then add 1 table-spoonful butter and 1 tea-spoonful brown sugar. Boil 10 minutes longer, then pour into buttered pans.

6283. Everton Taffee. To make this favorite and wholesome candy, take 1½ pounds moist sugar, 3 ounces butter, 1½ teacups water, and 1 lemon. Boil the sugar, butter, water, and half the rind of the lemon together, and when done (which will be known by dropping into cold water, when it should be quite crisp) let it stand aside till the boiling has ceased, and then stir in the juice of the lemon. Butter a dish, and pour it in about ¼ inch in thickness. The fire must be quick, and the taffee stirred all the time.

6284. To Make Cream Rise. Cream cannot rise through a great depth of milk. Therefore, if milk is desired to retain its cream for a time, it should be put into a deep narrow vessel; but if it be desired to free it almost completely of cream, it should be poured into a broad flat dish, not much exceeding one inch in depth.

6285. To Clear all Kinds of Sugar. Take a little gum arabic, and a little isinglass dissolved in hot water; pour it, when dissolved, in your sugar, when it is boiling, and it will clear all the sediment to the top of the pan, which must be skimmed off as soon as it rises. Loaf sugar may be cleared with the white of an egg, isinglass, or gum arabic. A little of each will do. (*See No.* 1357.)

6286. To Keep a Churn from Frothing Over. Take the body of the churn and cut a groove around the inside of the mouth, about 3 inches from the top and ⅜ inch deep, and then remove half the thickness of the wood, making a shoulder all around; then take the cover and cut it to fit nicely inside, and you have now done away with the necessity for cloths, tubs, pans, &c., heretofore required to save the cream flowing over.

6287. To Make French Coffee. A French coffee pot consists of two tin vessels, one on top of the other. In the upper one is a strainer, and a tin plate pierced with holes. The coffee, ground almost as fine as gunpowder, is poured into the strainer, and the plate with the holes put over it. Boiling water is then poured in and filters through into the bottom vessel or pot. The pot should be kept on the range or stove, a few moments, until scalding hot, and the fluid which has filtered through poured in at the top again, which will extract all the flavor of the berry, and make a cup of coffee far superior to that boiled. Liebig says, however, that a portion of the coffee should be kept out, thrown into the bottom of the vessel, and there permitted to steep, like tea. This, he says, gives the flavor, while the infiltrated portion gives the strength. We have tried this experiment with great success, and find it a vast improvement over the method of simply pouring boiling water on the top; it is, moreover, economical, because the ground coffee is exhausted more completely than by simple immersion in hot water. After standing a few moments, it is as clear as spring water, and as deep colored as claret. A still better plan, in making coffee by the filtering method, is thus: place the ground coffee in the filter, cover it closely; then pour sufficient boiling water in the coffee-pot (*not into the filter*) to cover the bottom about ⅛ inch. Place the filter in the coffee-pot, and set the whole on the stove or fire, so that the water will boil and its steam rise and soften the coffee in the filter. In about 5 minutes, empty out the water, and pour boiling water through the filter as usual. The ground coffee will be so thoroughly exhausted of its strength and aroma that it will not bear twice watering. Coffee should never be brought in contact with iron. Tinned coffee-pots that have been used for some time are apt to get worn on the surface, so that the iron the tin plate is made of comes through. When this occurs the coffee will be bitter and black, for it attacks iron, forming an acid very quickly. This any one can see by putting a few drops on a case-knife. Above all, to have good coffee, the pot must be scrupulously clean.

6288. To Keep Suet. Suet chopped fine and mixed with flour, if tied down tight in a jar will keep 10 days or 2 weeks, and is very nice to use for puddings or pastry. If there be more suet than will be used while fresh, throw it into a pickle made in the proportion of 4 ounces salt to 1 quart cold water. It must be freshened by laying it in fresh water an hour or two before using it, and will then be as nice as fresh suet. Or the suet may be rendered down, and poured into a pan containing about an inch of cold water. When cold, take off the suet (the impurities will have fallen to the bottom of the water), and pack it away in jars for future use. Do not put in salt, if it is intended to use for frying, as salt prevents articles from browning easily.

6289. Imitation Asses' Milk. The following preparations are used freely as substitutes for asses' milk, and may be administered in cases of consumption and general debility, a tea-cupful 3 or 4 times a day, either plain or with a spoonful of rum.

Mix the whites of 2 eggs with ¾ pint new cow's milk, and 1 ounce sugar; add ¾ ounce syrup of tolu.

6290. Factitious Asses' Milk. Boil 1 ounce hartshorn shavings to a jelly in 1 pint water, adding 2 ounces white sugar; when cool add 1 pint new cow's milk and ½ ounce syrup of tolu. Used as in the last receipt.

6291. Liqueur de la Grande Chartreuse. According to Dr. Chevalier, this celebrated liqueur, made at the Abbey of the name, near Grenoble, is composed of essence of melissa citrata, 31 grains; essence of hyssop, 31 grains; essence of angelica root, 154 grains; essence of best mint, 309 grains; essence of nutmeg, 31 grains; essence of cloves, 31 grains; and 4½ pints rectified spirits of wine, of best quality. The liquid is artificially colored, either with turmeric or any other suitable material.

6292. Doppel Kummel. To 5 gallons 94 per cent. alcohol, add 4 ounces oil of caraway, ½ drachm (30 drops) oil of anise, 5 drops oil of coriander, 5 drops oil of bitter almonds, and 10 drops oil of calamus. Add 20 gallons French proof spirit, and 15 gallons water in which 10 pounds white sugar have been dissolved. This will make 40 gallons kummel of a strength of 36¾ per cent. If for cordial, more sugar may be added.

6293. To Improve Cheap Bourbon. Inferior Bourbon whiskey may be much improved in quality by the addition of the peach flavoring given in No. 6294. From 1 to 1½ gallons of the flavoring should be added to 40 gallons of whiskey. This will give it a fruity taste.

6294. Peach Flavoring for Whiskey by a New Method. Take a 50-gallon pipe; at 4 or 5 inches from the bottom place a false bottom, perforated with ¼-inch holes. Cover this false bottom with a thin layer of straw, laid uniformly; this again covered by a thin even layer of straw laid at right angles across the lower layer. Then pack 10 gallons dried peaches regularly, without pressing them; add 5 pounds black tea evenly sprinkled over the peaches, and cover the whole with a cloth. Next pack 10 gallons oak sawdust evenly, and cover it also with a cloth. Place some pieces of lath over the cloth, with some middle-sized stones to keep the sawdust down. Insert a faucet in the side of the pipe, between the bottom and the false bottom. Now add 20 gallons proof spirit, and draw off, three times every day, 15 gallons of the tincture, and pour it back immediately. As the sawdust acts as a filter, the tincture will be ready for use and bright in 10 or 15 days. If a greater quantity is required, double the above proportions and use a gin cask.

6295. To Improve Wine by Electricity. The process consists in plunging into the vat containing the wine, two plates of platinum or of silver, having attached to them two wires of the same metal, which are connected with the poles of an electric battery. The Bunsen and Daniell's batteries are much used in France for this purpose. The time necessary to transform a low grade wine to one of an agreeable and superior quality, is from two to three weeks, with the battery continually working. By this method, wines which were considered only fit for making vinegar, are changed to such an extent that they are used as good, and in some cases superior table wines. (*See No.* 726.)

6296. Pharaoh's Serpents Eggs are made in the following way: Take mercury and dissolve it in moderately dilute nitric acid by means of heat, taking care, however, that there be always an excess of metallic mercury remaining; decant the solution, and pour it into a solution of sulpho-cyanide of ammonium or potassium, which may be bought at a good drug store, or of a dealer in chemicals. Equal weights of both will answer. A precipitate will fall to the bottom of the beaker or jar, which is to be collected on a filter and washed two or three times with water, when it is put in a warm place to dry. Take for every pound of this material 1 ounce gum tragacanth which has been soaked in hot water. When the gum is completely softened it is to be transferred to a mortar, and the pulverized and the dried precipitate gradually mixed with it by means of a little water, so as to present a somewhat dry pill mass, from which pellets of the desired size are formed by hand, put on a piece of glass, and dried again; they are then ready for use.

6297. Pharaoh's Serpents Eggs. A substitute, nearly as good as the original mercury compound, and superior in not being poisonous, is prepared in the following way: Take bichromate of potassa, 2 parts; nitrate of potassa, 1 part; white sugar, 3 parts. Pulverize each of the ingredients separately, and then mix them thoroughly. Make small paper cones of the desired size, and press the mixture into them. They are now ready for use, but must be kept from moisture and light.

6298. Solidified Glycerine for Toilet Use. Transparent soap, 1 ounce; water, 4 ounces; inodorous glycerine, 24 ounces. Dissolve the soap in the water by heat, adding an equal weight of glycerine. When dissolved, add the remaining portion of glycerine, and sufficient water to make up the weight. When nearly cold, add any suitable perfume and pour in glass jars. It has a very pale amber color, is transparent, melts easily on the skin, and leaves no residue.

6299. To Remedy a Scattering Gun. To prevent a gun from scattering, insert a ring about half an inch in width in the nozzle of the gun, beveling from the outer edge to nothing at the inward. It can be fastened in with rivets. It should be made of metal about $\frac{1}{16}$ of an inch in thickness, and be fitted very neatly.

6300. Preservation of Stone. Doctor Eugene Robert, of Paris, recommends copper salts as being the best preservatives of stone in a damp climate. These salts prevent the formation of lichens, to the action of which M. Robert attributes the destruction of stone. This is, without doubt, true for granite, but its efficiency for sandstone is questionable. The latter deteriorates by exfoliation, without the development of any vegetation.

6301. Ground Tea. A French chemist asserts that if tea be ground like coffee before hot water is poured upon it, it will yield nearly double the amount of its exhilarating qualities.

6302. To Impart a Fine Flavor to Tea. To impart a fine flavor to ordinary tea, place rose leaves in the tea-canister, or add one drop of the attar of roses on a piece of soft paper to every pound of tea, and keep the canister closely covered.

6303. To Prevent Stoves From Rusting. Kerosene applied with a rag to stoves will keep them from rusting during the summer. It is also an excellent material to apply to all iron utensils used about a farm.

6304. To Remove Pin-Spots from Steel. Get a small iron box with a sliding top to it, fill it with pulverized charcoal, and imbed the pieces of steel in it, put in the top, and lute with fire-clay. Heat it in a slow fire, to a red heat, then take out and let it cool off.

6305. Remedy Against the Cracking of Wooden Taps and Faucets. This is best prevented by putting the taps and faucets in melting paraffine, and heating them there at a temperature of 212° Fahr., until bubbles of air cease to escape from the wood. The whole is then allowed to cool to about 120° Fahr., when the taps are taken from the bath and cleaned from the adhering paraffine by rubbing with a dry coarse piece of cloth.

6306. French Composition for Washing. Dissolve 1 pound hard soap in 6 gallons of water, then add $\frac{1}{4}$ ounce spirits of turpentine and $\frac{1}{2}$ ounce spirits of hartshorn.

6307. Cheap Family Soap. Add to 10 quarts of water, 6 pounds of quicklime (shell lime is best), and 6 pounds common washing soda. Put all together and boil for half an hour, and let it stand all night to clear. Draw off the lye, and add to it 1 pound common resin and 7 pounds of fat (any fat will do). Boil this for half an hour, then let it stand till cool, and cut into bars.

6308. To Make a Bad Yellow Soap Good and Hard. Heat a solution of 28 pounds hyposulphite of soda in 4 gallons water, with 250 pounds of bad yellow or brown soap, and the result will be a good hard soap. This is Desborough's patent.

6309. To Preserve Soap Grease. Fill a cask half full of good strong lye and drop all refuse grease therein. Stir up the mixture once a week.

6310. Waterproof Starch. This is a French patent, and consists in passing the goods, after being properly starched, through a bath of chloride of zinc at a temperature of about 60° Fahr. The starch will then remain in the clothes after several successive washings.

6311. Cement to Resist Sulphuric Acid. Melt caoutchouc by a gentle heat, add from 6 to 8 per cent. of the weight of tallow, taking care to keep the mass well stirred; add dry slacked lime, so as to make the fluid mass the consistency of soft paste; and lastly add 20 per cent. of red lead, whereby the mass, which otherwise remains soft, becomes hard and dry. This cement resists, according to Dr. Wagner, boiling sulphuric acid. A solution of caoutchouc in twice its weight of raw linseed oil, aided by heating, and the addition thereto of an equal weight of pipe-clay, yields a plastic mass which also resists most acids.

6312. Cement for Fixing Glass Letters. A thick solution of marine glue in wood naphtha will answer perfectly if color is no object. But the glass must be chemically clean, and this is not always easy. The least trace of soap or grease will spoil the adhesion of any cement. Try soda or ammonia, followed by whiting and water, clean cloths, and plenty of rubbing, and let the cement dry on the letters till the surface just begins to be "tacky" before you apply them.

6313. New Process for Rendering Cloth Waterproof. This is a method for rendering fabrics waterproof without destroying their ventilating qualities. Place in a metal vessel of about 6 gallons capacity, 20 pounds sulphate of alumina cut in thin slices; and in another similar receptacle 8 pounds oleic acid and 6 quarts alcohol. Thoroughly dissolve the latter compound, and stir it with a wooden stick for 20 minutes, gradually adding the sulphate of alumina. Leave the whole for about 24 hours to settle. The oleic acid and the spirit will then be at the surface, and can be decanted; the remaining deposit should be filtered through flannel, and pressed into a cake. This can be dried by heat, and ground to a powder. For use on silken or linen clothes, 1½ pounds to 20 gallons of water will be ample; wool will not require more than 1 pound. It is as well to strain these solutions, and the fabrics require only to be thoroughly saturated and dried in the air.

6314. To Clarify Quills. Cut off the small top of the quills, tie them loosely in bundles, fix them nearly upright in a saucepan of water in which a small piece of alum has been dissolved, about the size of a walnut of alum to a quart of water; let them boil slowly until they become clear; add a little turmeric or a small pinch of saffron to the water, to give them the yellow color; dry them in the sun. Tie paper round the feather part of the quills, to keep them from dust. The quantity of alum may be increased according as you wish the quills more or less brittle.

6315. New Glazing for Frescoes. Dr. Vohl announces that paraffine, mixed with benzole or Canada balsam, affords a glazing for frescoes much superior to soluble glass. By covering the interior of wine casks with a film of pure white paraffine, poured in melted, he has effectually prevented the spoiling of the wine and its evaporation through the wood.

6316. To Bend Gas Pipe. This may be done by filling the pipe with melted resin. When the resin hardens, bend the pipe, and it will retain its round form. Remove the resin by heating.

6317. Chewing Gum is made as follows: Take of prepared balsam of tolu, 2 ounces (*see second receipt in No.* 5102); white sugar, 1 ounce; oatmeal, 3 ounces. Soften the gum in a water-bath and mix in the ingredients; then roll in finely-powdered sugar or flour, to form sticks to suit.

6318. Chewing Gum from Paraffine. This article may be made by dissolving paraffine at a gentle heat in a very little olive oil and glycerine. It is stirred on cooling, and afterwards compressed. The amount of glycerine depends on the consistency to be desired, and must be determined by the character of the paraffine employed. This latter consists of mixtures of various carbo-hydrides, and is by no means always of the same composition and properties. The glycerine will keep it soft and make it sweet at the same time.

6319. Boot Powder. Scraped or powdered French chalk is used by bootmakers to make new boots or shoes go on easily, by rubbing or dusting a little of it on the inside of the heel and instep of the boot.

6320. Electric Tissue. Steep linen or cotton 1 hour in a mixture of 1 part strong sulphuric acid and 3 of pure nitric acid; squeeze out the acid, wash with water until no sensible acidity remains, plunge it in a weak alkaline solution, then in water, and dry. By friction it yields a large quantity of resinous electricity.

6321. To Make Modeling Clay. Knead dry clay with glycerine instead of water, and a mass is obtained which continues moist and plastic for a length of time, thus removing one of the greatest inconveniences experienced by the modeler.

6322. To Remove Stains from Knives. The very best way to clean a stained steel knife is to cut a solid potato in two, dip one of the pieces in brick-dust (such as is usually used for knife-cleaning), and rub the blade with it.

6323. To Prevent Ivory Knife Handles from Cracking. When the blades of knives require washing or standing in water, it should be done in a pitcher, with water enough to cover the blades, but not to touch the handles; and the water no hotter than is absolutely necessary. Soaking the handles in water makes them crack.

6324. To Cleanse Goose Feathers. Feathers are prepared by exposing them to the sunshine or in a stove until perfectly dry, and then beating them to remove dust and loose dirt. When carelessly collected and dirty, they may be cleansed with lime-water; or, still better, with a weak solution of carbonate of soda, or with water containing a little solution of chloride of lime; after which they are rinsed in clean water, and dried as before. (*See No.* 659.) Old feathers are purified and cleansed in the same way.

6325. Coloring Castor Oil. Make a strong tincture of turmeric root with strong alcohol, and add a few drops to the oil until you have the desired color. Rather than being a disadvantage, it will prove a benefit, tending to prevent griping.

6326. **Labels for Damp Situations.** Write on the back of adhesive plaster. Labels made of this substance are not affected by damp, and adhere strongly.

6327. **To Reproduce a Beautiful White on Flannel Goods Turned Yellow by Age.** For the restoration of old flannels to their original color, Professor Artus recommends the following method: Dissolve 2¼ pounds white Marseilles soap in 75 pounds soft water, and to the solution add, under constant stirring, 1 ounce liquor ammonia. The goods are soaked in this fluid, and afterwards well washed with water. The object may be accomplished, however, more quickly, by putting the goods for 1 hour in a dilute solution of bisulphite of soda, and adding, under constant stirring, some dilute hydrochloric acid, when the vessel has to be covered and the goods left in it for 15 minutes longer. They are then thoroughly washed in water.

6328. **Sizing for Holland Linen.** The sizing or dressing employed for the Holland used for window shades is prepared as follows: Take 1 part crystallized carbonate of soda; 4 to 6 parts each white wax, stearine, and pure white soap; 20 parts carbonate of magnesia or fine Paris white; 40 parts potato starch, and 100 parts fine wheat starch. Boil these together with sufficient water to make 1600 parts altogether. A little ultramarine is added, if needed, to counteract the yellow tint of the linen, which is starched with this preparation, passed between rollers, and dried. It is then sprinkled with soap water, placed in a stamping mill, and afterwards steamed and calendered.

6329. **Starch Lustre** is a substance used for washing purposes, which, when added to starch, causes the linen to which it is applied to assume not only a high polish, but a dazzling whiteness. A piece of lustre of the size of a copper cent added to ½ pound starch, and boiled with it for 2 or 3 minutes, will produce the best results. The starch lustre consists of stearine, colored by a slight addition of ultramarine blue, the essential ingredient being the stearine; and, with or without the coloring matter, will be found to add very much to the beauty of linen articles to which it is applied. (*See Nos.* 497, *&c.*)

6330. **To Clean Windows and Mirrors.** Tie up some finely powdered whiting in a small piece of muslin. Dab it over the glass thoroughly; the dirtier the glass the more whiting will adhere to it. Next smear it evenly with a damp rag, and let it remain until perfectly dry; then rub it off with a leather. This is an easy, clean, and thorough plan. If alcohol be used instead of water, it will dry in much less time, and polishes the glass fully better. The corners of the window-panes should receive particular attention; they are too often left dirty, and spoil the appearance of the window.

6331. **To Wash Mirrors or Windows.** For washing finger-marks from looking-glasses or windows, put a few drops of ammonia on a moist rag, and make quick work of it.

6332. **Ganteine.** A composition for cleaning kid gloves; sometimes improperly termed *Saponine.* Dissolve 3 troy ounces soap by heat in 2 ounces water, and when nearly cold add 2 ounces javelle water and 1 drachm water of ammonia; form a paste, which is to be rubbed over the glove with flannel till sufficiently clean.

6333. **To Clean and Preserve Brewing Utensils.** In cleaning them before being put away, avoid the use of soap, or any greasy material, and use only a brush and scalding water, being particularly careful not to leave any yeast or fur on the sides; then place them away in a clean and moderately dry situation. Should they become tainted or mouldy, take a strong lye of pearlash, which spread over the bottoms of the vessels scalding hot, and then with the broom scrub the sides and other parts. Or: Take common salt and spread it over the coolers, &c., and strew some on their wet sides, pour in scalding water and scrub them with a broom. Or: Throw some quicklime into water in the vessel, and scrub over the bottom and sides with it; in each case well washing afterwards with clean water. Or: Wash well first with oil of vitriol diluted with 8 times its weight of water, and afterwards with clean water.

6334. **To Restore the Color of an Acid Stain on Violet Silk.** Acid dropped on violet-colored silk destroys the color; to restore it, brush the discolored stain with tincture of iodine; then, after a few seconds, saturate the spot well with a solution of hyposulphite of soda, and dry gradually; the color will be perfectly restored.

6335. **To Transfer Engravings onto Glass.** First coat the glass with copal varnish, then press on the picture, face downwards, smoothly and tightly; let it dry. Next damp the paper slightly, and rub it off with the finger, leaving the picture to be looked at through the glass.

6336. **To Transfer Engravings on Wood, Stone, &c.** Take a saturated alcoholic solution of potash, pour the solution on the engraving, and immediately remove all the superfluous liquid by means of blotting paper. Lay the engraving, while damp, upon the wood or other material to which it is to be transferred, and place it in a press. (A small printing press is the best.) The transfer will be obtained immediately. The engraving must be immersed in clear, cold water, after removal from the potash bath. (*Orr.*)

6337. **How to Wash Printing Rollers.** Avoid all grit, sand, and dirt; simply use strong ley to loosen the ink, and quickly, with a soft sponge, wash the ley off with water (in winter blood-warm) squeezing the sponge dry, face up the roller, so that no moisture remain thereon. Let it then stand exposed to the air one hour, machine rollers two hours, before distributing ink on its surface. The time for exposure must be guided by the state of the weather, as shorter time will do in dry or windy weather. Be careful to ink the roller as soon as possible after exposure, to keep it tacky. (*See No.* 2542.)

6338. **Gelatine Capsules.** A strong solution is made of 6 parts gelatine and 1 part sugar; the extremity of a rod of bulbous shape is oiled, and dipped into the solution; when the rod is withdrawn it is rotated, in order to diffuse the fluid jelly equally over its surface; as soon as the gelatinous film has partially hardened, it is removed from the mould and placed on pins furnished with suitable heads, and fixed on a cork table. When dry, the capsules are placed upright in little cells made in the table to receive them, and the liquid with which they are to be filled is introduced by means of a small glass tube. They are then closed by dropping some melted gelatine on the orifice of each. Ricord recommends that capsules containing copaiba be coated with extract of rhatany, which is easily done by immersing the capsule for an instant in a mixture of 3 parts newly prepared extract of rhatany, 1 part syrup of moist sugar, and 1 part mucilage of gum arabic, melted together in a water-bath. Capsules thus prepared are said to act with greater certainty, as well as improving the tone of the stomach.

6339. To Remove Nitrate of Silver Stains. A solution of iodide of potassium will freely dissolve iodine. Silver stains moistened for a while with this solution will be converted into iodide of silver, which is soluble in iodide of potassium. The stains will therefore have disappeared when the cloth, after the foregoing treatment, is washed in water. (*See No.* 385.) Perhaps the best method of removing these stains is as follows: The stained cloth is washed with a concentrated solution of sulphate or chloride of zinc and then touched with a piece of metallic zinc. This same process may be used for the removal of ink stains in both cases without danger to the fabric. After the color has disappeared, they are washed first with pure water and then with water and soap. No visible traces of the stains are left behind. (*See No.* 3141.)

6340. To Remove Nitrate of Silver Stains from Woven Tissues. According to M. Grimm, chloride of copper completely removes, even from colored woven cotton tissues, stains occasioned by nitrate of silver; the tissue is to be afterwards washed with a solution of hyposulphite of soda, and next thoroughly washed with water. From white cotton and linen tissues, nitrate of silver stains are more readily and effectually removed by applying dilute solution of permanganate of potassa and hydrochloric acid, followed by washing with hyposulphite of soda solution, and rinsing in plenty of fresh water. By these means the use of the highly poisonous cyanide of potassium is rendered unnecessary. (*See Nos.* 385 *and* 3141).

6341. To Dissolve Old Blood Stains. Dr. Helwig recommends a solution of iodide of potassium in four times its weight of water.

6342. Silk Cleaner. Mix well together ¼ pound soft soap, a tea-spoonful of brandy, ½ pint proof-spirit, and ½ pint water. It is to be spread with a sponge on each side of the silk without creasing it; the silk is then rinsed out 2 or 3 times, and ironed on the wrong side. (*See No.* 460.)

6343. Fluid for Removing Grease Stains from Silk, &c. A fluid for removing greasy stains from silk, &c., may be prepared by mixing 2 ounces rectified spirits of turpentine, ¼ ounce absolute alcohol, and ¼ ounce sulphuric ether.

6344. To Remove the Stains of Benzine. In removing grease spots from fabrics by means of benzine or petroleum it often happens that a colored and stained outline of the portion moistened is left. This can be prevented by the application of a layer of gypsum extending a little beyond the moistened region. When dry, the powder is to be shaken and brushed off, when no trace of the spot will remain.

6345. To Clean Silver. To clean silver utensils, blackened by sulphuretted hydrogen, Boettger recommends a boiling saturated solution of borax, or a solution of caustic potash, with some fragments of metallic zinc.

6346. To Clean a Wedgwood Mortar. A solution of caustic potash will usually be effectual; this may be triturated in the mortar with fine sand or powdered pumice-stone. Sometimes sulphuric acid will serve a better purpose. Chlorinated lime (chloride of lime) will sometimes remove the color where it is a stain merely.

6347. To Dye Gutta-Percha. Dissolve 1 ounce gutta-percha in chloroform, and add ½ grain of pure carmine, previously mixed with a little powdered gum and water; then distill off the chloroform and knead well the remaining gutta-percha. In the same way ultramarine, ochre, oxide of chrome, &c., may be used.

6348. To Clean Gutta-Percha. This can be done by using a mixture of soap and powdered charcoal, polishing afterwards with a dry cloth with a little of the charcoal on it.

6349. To Dye Straw Hats Black. The following is given as a black color for straw hats. The quantities of material are intended for 25 hats or bonnets. They are kept for 2 hours in a boiling decoction of 4 pounds logwood, 1 pound sumach, and 5 ounces fustic; and afterwards dipped into a solution of nitrate of iron of 4° Baumé, then well rinsed with water, and, when dry, are painted over with a solution of lac or dextrine.

6350. To Dye Leather Yellow. Picric acid gives a good yellow without any mordant; it must be used in very dilute solution, and not warmer than 70° Fahr., so as not to penetrate the leather.

6351. To Dye Leather Green. Aniline blue modifies picric acid to a fine green. In dyeing the leather, the temperature of 85° Fahr. must never be exceeded.

6352. To Dye Leather Green. Aniline green is well adapted to dyeing leather, and its application is quite simple. Whether used in paste or as powder, we must make a concentrated aqueous solution. The leather is brushed over with a solution of sulphate of ammonia, mixed with water, the dye solution applied at 95° Fahr., and it must be endeavored, by rapid manipulation, to prevent the dye from penetrating through the leather. By the addition of picric acid, the blueish shade of this dye-stuff is modified to leaf green, and it becomes faster; but the picric acid must not be added to the color solution; it must be applied to the leather before or after the dyeing with aniline green. (*Springmuhl.*)

6353. Slating for Black-Boards. The imitations of slate are of two kinds, real imitations, consisting of pulverized slate or quartz rock moistened to the consistency of a thick fluid with silicate of soda (water-glass of commerce), and applied to the boards by means of a brush; or merely paints, such as asphaltum or Grahamite dissolved in petroleum naphtha. The first one will produce slates that are very similar to the natural slates, less expensive than those, and last a good while.

6354. Asphalt for Walks. Take 2 parts very dry lime rubbish, and 1 part coal-ashes, also very dry, and both sifted fine. In a dry place, on a dry day, mix them, and leave a hole in the middle of the heap, as bricklayers do when making mortar. Into this pour boiling hot coal-tar; mix, and when as stiff as mortar put it 3 inches thick where the walk is to be; the ground should be dry, and beaten smooth. Sprinkle over it coarse sand. When cold, pass a light roller over it; in a few days the walk will be solid and waterproof.

6355. To Make Gravel Walks. The bottom should be laid with lime-rubbish, large flint stones, or any other hard matter, for 8 or 10 inches, to keep weeds from growing through, and over this the gravel is to be laid 6 or 8 inches thick. This should be laid rounding up in the middle, by which means the larger stones will run off to the sides, and may be raked away; for the gravel should never be screened before it is laid on. It is a common mistake to lay these walks too round, which not only makes them uneasy to walk upon, but takes off from their apparent breadth. 1 inch in 5 feet is a sufficient proportion for the rise in the middle; so that a walk 20 feet wide should be 4 inches higher at the middle than at the edges, and so in proportion. As soon as the gravel is laid, it should be raked, and the large stones thrown back again; then the whole should be rolled both lengthwise and crosswise; and the person who draws the roller should wear shoes without heels, that he may make no holes, because holes made in a new walk are not easily remedied. The walks should always be rolled 3 or 4 times after very hard showers, which will bind them more firmly than could be accomplished by any other method.

6356. Polishing Powder for Specula. Precipitate a dilute solution of sulphate of iron by ammonia in excess; wash the precipitate, press it in a screw press till nearly dry, then expose it to heat until it appears of a dull red color in the dark. (*Lord Ross.*)

6357. To Make a Voltaic Pile. Take disks of copper, zinc, and woolen cloth of any size, soak the cloth in a solution of sal-ammoniac, then pile them up in the following order: Copper, zinc, cloth, and so on. The relative position of the metals in each pair must be observed throughout the whole series, so that, if the pile commences with a copper plate, it shall terminate with a zinc one. These two extremes are called the poles. Zinc is called the positive pole, and copper the negative pole. The outer disks are connected with copper wire, that the electric or galvanic stream which is excited in the pile may be conveyed to any place desired. When the two ends of the wires are brought very near to each other, sparks are seen to dart from one to the other; this is a token of the galvanic current, manifesting itself in the same manner as the current of the electrical machine. The larger the disks and the greater their number, the greater is the intensity of the current.

6358. To Make a Cistern. A good cistern can be made in a solid clay soil, if not in an exposed situation, by cementing against the sides of the ground. Where the ground freezes we would not recommend such a practice, but lay a wall of cobblestones in a mortar of cement, and face the wall with a thick coating of clear mortar. Great care must be exercised to get good cement, and mix it with coarse sand. Fine sand will not do at all. 1 part cement and 3 parts sand is the usual proportion, to be used as soon as mixed. Every part of the wall must be laid below the reach of the frost. This can be done, and an iron or wooden pipe or throat lead to the surface, through which the pump can pass. A cheap and excellent cistern can be constructed of wood, in the form of a large cask, or a tank made of pine or cedar plank. When sunk into the ground, and kept constantly wet, it will last for years. A better way is to place the tank or cask in one corner of the cellar, with a faucet in the bottom, from which the water is easily drawn when it is desirable to clean it out and when water is required in the cellar. An open cistern in a cellar will rarely freeze.

6359. To Purify Water. Chloride of iron and carbonate of soda, in the proportion of 10 parts by weight of the former salt and 26½ of the latter to a quantity of water equal to 20,000 parts, has been found a most valuable and quite innocuous means of purifying water, even such as is otherwise quite unfit for drinking purposes, and could not be rendered fit by alum. The salts alluded to are best previously dissolved in some pure water, and the solutions, that of iron first, poured into the tank containing the water intended to be operated upon. The soda solution is not added until after a few moments, the water being first vigorously stirred. The soda solution having been added, the fluid is stirred again, and then left quiet for the purpose of allowing the very bulky and flocculent sediment to deposit; this takes considerable time—from 24 to 36 hours.

6360. Gutta-Percha Tissue. If a solution of gutta-percha in chloroform be mixed with 3 parts of ether and exposed for some time to a temperature below 15° Fahr., the gutta-percha will be precipitated as a white powder, forming, when washed and dried, a soft white mass. If some of this solution be spread on a plate of glass, a skin is formed, resembling kid-glove leather, which becomes transparent on the application of heat. These films are beautifully white if carefully prepared, and have been employed in the manufacture of the finest kinds of artificial flowers.

6361. Mosaic Silver. Take 2 parts each pure tin and purified bismuth, melt them together by a moderate heat, and add 1 part purified mercury. When cold reduce the mass to a fine powder. (*Hager.*)

6362. Mosaic Gold. Melt 12 ounces pure tin, by a gentle heat, add 6 ounces mercury, and reduce to powder; when cold, add

6 ounces muriate of ammonia, and 7 ounces flowers of sulphur; mix thoroughly. Place the compound in a glass flask, and gradually heat to redness in a sand-bath, continuing the heat till all white fumes cease; during this operation bisulphuret of mercury, muriate of tin and sal-ammoniac are sublimed, leaving the mosaic gold at the bottom of the flask in soft, brilliant, gold-colored flakes. Mosaic gold, also called *Aurum Musivum*, is therefore the *bisulphuret of tin*. (*Cooley.*)

6363. To Preserve Pencil and Indian Ink Sketches. To a solution of collodion of the consistency used by photographers, add 2 per cent. of stearine. The drawing is then spread on a board or plate of glass and the collodion poured over it as in photography. (*See No.* 3143.) It dries in 10 to 20 minutes, and so thoroughly protects the drawing that it may be washed without fear of injury.

6364. Golden Compound. Melt anhydrous tungstate of soda in a porcelain crucible, over a spirit lamp, at a temperature not more than sufficient to fuse it. Add small pieces of pure tin to the melted mass, and cubes of a golden color instantly form. The process should not be continued too long, or they acquire a purple hue.

6365. Ink for Writing on Tin Plates. Mix together without heat, 1 part pine soot, with 60 parts of an aqueous solution of nitrate of copper. (*Hager.*)

6366. Black Stencil Ink. Triturate together 1 part pine soot and 2 parts Prussian blue with a little glycerine, then add 3 parts gum arabic, and sufficient glycerine to form a thin paste.

6367. Factitious Beef Marrow. Mix together, by dissolving at a gentle heat, 2 parts fresh hogs' lard and 1 part cacao butter.

6368. To Obtain Absolute Alcohol. A German savant has recently improved on the well-known method employed by Mendelejeff, for obtaining absolute alcohol. Strong alcohol is boiled with quicklime, the pieces of the latter projecting above the surface of the liquid for ½ hour or more, with a condenser inverted so that the liquid may return by its own gravity to the flask. The condenser is then reversed, and the alcohol redistilled. If the alcohol contains more than 5 per cent. of water, the process must be repeated 2 or 3 times. The vessel should only be half filled with the pieces of lime, as the rapid formation of hydrate of lime may break it to pieces. (*See No.* 1442.)

6369. Bougie. A long slender instrument, introduced into the urethra, œsophagus, or rectum, to overcome strictures of those canals. Add 3 parts boiled linseed oil to 1 part melted amber, and when mixed add 1 part oil of turpentine; spread the mixture at 3 successive intervals upon loose spun silk cord or web, dry in a heat of 150° Fahr., and repeat the process until the instrument has acquired the proper size, then polish, first with pumice-stone, and afterwards with tripoli and oil. This is the original receipt of the French Professor Pickel, and is still generally used in Europe, slightly modified as follows: Add to the oil and amber, melted together as last, caoutchouc in the proportion of $\frac{1}{20}$ of the weight of the oil employed; when dissolved, remove the vessel from the fire and proceed as before.

6370. Hunter's Bougie. Boil slowly together, until combination takes place, 2 parts yellow wax, 3 parts red lead, and 6 parts olive oil; strips of soft linen, rather wider at one end than the other, are then dipped into the composition, rolled up firmly, and finished on a polished slab.

6371. Catheters, or Hollow Bougies. These are made of the same composition as the ordinary bougies, but a piece of polished metallic wire is introduced into the axis of the silk; or tinfoil is rolled round the wire and the composition applied as before.

6372. Caoutchouc, or Elastic Gum Bougies. These are made by applying an ethereal solution of india-rubber to the silk or foil prepared as in the foregoing methods. Where ether is expensive naphtha is employed, but it furnishes a very inferior product. Sometimes slips of india-rubber previously boiled in water, or that have had their edges softened with ether, are wound round the wire or foil, and kept in their place by a piece of tape applied over them, as in making elastic tubes. They are afterwards carefully smoothed off and polished.

6373. To Prevent Lamp Chimneys from Cracking. Put the chimneys into a kettle of cold water, and gradually heat it until it boils, and then let it as gradually cool; the chimneys will not be broken by the ordinary fluctuation of the flame of the lamp.

6374. To Mend Rubber Overshoes, &c. Rub the patch and shoe thoroughly with sharp sand paper. Smear both with liquid rubber 5 times, every time letting them dry. Do this once more, and, before they dry, apply the patch, with pressure if possible, and the boot is mended. If liquid rubber is not obtainable, dissolve small pieces of pure rubber (not vulcanized), in warm spirits of turpentine, to the consistence of syrup.

6375. To Preserve and Restore Oil Paintings. Many valuable paintings suffer premature decay from the attacks of a microscopic insect of the mite class. The best method of preventing this species of decay is to add a few drops of creosote to the paste and glue used to line the picture, as well as to make a similar addition to the varnish. If it has already commenced, the painting should be at once carefully cleaned and relined, observing to employ a little creosote in the way just mentioned. Paintings should be kept in as pure an atmosphere as possible, and in a moderately dry situation; as it is the presence of sulphuretted hydrogen in the air that blackens the "lights," and causes most of the middle tints and shades to fade; and it is exposure to damp that produces mouldiness and decay of the canvas. For this reason valuable paintings should not be kept in churches, nor suspended against heavy walls of masonry, especially in badly ventilated buildings. Excess of light, particularly the direct rays of the sun, also acts injuriously on paintings. The blackened lights of old pictures may be instantly restored to their original hue by touching them with deutoxide of hydrogen, diluted with 6 or 8 times its weight of water. The part must be afterwards washed with a clean sponge and water.

6376. Compressed Leather. A new process for using the clippings and refuse from saddlers' and shoemakers' shops is as follows: The leather shavings are washed clean, cut up fine, and soaked in water and sulphuric acid, 1 per cent. of the acid being sufficient. The immersion must continue till the shavings become plastic, and the leather then can be pressed into moulds with only a moderate amount of pressure. It can be rolled into thin sheets, and will be useful for many purposes; it will not, however, resist moisture. A little glycerine rubbed in will prevent its cracking.

6377. To Render Walls Water-tight. It is proposed by Mr. F. Ransome, of London, to render stone and brick walls waterproof by coating them to saturation with a solution of silicate of soda, which is superficially decomposed by the further application of chloride of calcium. The surface thus obtained consists of silicate of lime, which is perfectly insoluble, and therefore water-tight, while it does not alter the appearance of the wall. *(See No.* 2171.*)*

6378. To Wash Silks. No person should ever wring or crush a piece of silk when it is wet, because the creases thus made will remain forever if the silk is thick and hard. The way to wash silk is to spread it smoothly upon a clean board, rub white soap upon it, and brush it with a clean hard brush. The silk must be rubbed until all the grease is extracted, then the soap should be brushed off with clean cold water, applied to both sides. The cleansing of silk is a very nice operation. Most of the colors are liable to be extracted with washing in hot suds, especially blue and green colors. A little alum, dissolved in the last water that is brushed on silk, tends to prevent the colors from running. Alcohol and camphene, mixed together, are used for removing grease from silk.

6379. To Extinguish Fires. Dr. Clanny's solution consists of 5 ounces sal-ammoniac to 1 gallon water. The compound used in Phillip's Fire Annihilator is said to consist of dried prussiate of potash, sugar, and chlorate of potash.

6380. To Prevent Mouldiness. The best preventive is any of the essential oils, as the oil of lavender, cloves, peppermint, &c. Russia leather, which is scented with the tar of the birch tree, is not subject to mouldiness, and books bound in it will even prevent mouldiness in other books bound in calf, near which they happen to lie.

6381. To Keep Gum-Arabic from Moulding. Solutions of gum-arabic soon mould and sour, and finally lose their adhesive property. It is said that sulphate of quinine will prevent this, while it imparts no bad odor of its own. The addition of a solution of a few crystals of this salt to gum-arabic will prevent the formation of mould quite as effectually as carbolic acid, and by analogy it is safe to suppose that the same salt could be used in writing ink, mucilage, and, possibly, glue.

6382. To Prevent the Formation of a Crust in Tea-kettles. Keep an oyster-shell in your tea-kettle. By attracting the stony particles to itself, it will prevent the formation of a crust.

6383. Bird Lime. Boil the middle bark of the holly 7 or 8 hours in water; drain it, and lay it in heaps in the ground, covered with stones, for 2 or 3 weeks, till reduced to a mucilage. Beat this in a mortar, wash it in rain water, and knead it till free from extraneous matters. Put it into earthen pots, and in 4 or 5 days it will be fit for use. An inferior kind is made by boiling linseed oil for some hours, until it becomes a viscid paste.

6384. Substitutes for Lenses. Procure a piece of thin platinum wire, and twine it once or twice round a pin's point, so as to form a minute ring with a handle to it. Break up a piece of flint glass into fragments a little larger than mustard seed; place one of these pieces on the ring of wire, and hold it in the point of the flame of a candle or gas-light. The glass will melt and assume a complete lens-like or globular form. Let it cool gradually, and keep it for mounting. Others are to be made in the same manner; and if the operation be carefully conducted but very few will be imperfect. The smaller the drop melted, the higher in general will be its magnifying power. It may be mounted by placing it between two pieces of brass which have corresponding circular holes cut in them, of such size as to hold the edge of the lens. They are then to be cemented together. A perfectly round glass globe filled with pure water also makes a powerful lens.

6385. Ether Glue. An excellent liquid glue is made by dissolving glue in nitric ether. The ether will only dissolve a certain amount of glue, consequently the solution cannot be made very thick. The glue thus made is about the consistency of molasses, and is doubly as tenacious as that made with hot water. If a few bits of india-rubber, cut into scraps the size of buck-shot, be added, and the solution be allowed to stand a few days, being stirred frequently, it will be all the better, and will resist dampness twice as well as glue made with water.

6386. Brick-Dust Cement. Ordinary brick dust, made from hard burned, finely-pulverized bricks, and mixed with common lime and sand, is a good substitute for hydraulic cement. The proportions used in general practice are 1 part brick-dust and 1 of lime to 2 of sand, mixed together dry, and tempered with water in the usual way.

6387. Cement for a Crack in a Cast-iron Pot. If the crack be in the bottom of the pot, drill a hole at each extreme end of the crack, to stop further cracking, plug rivet the holes with copper, and, with fine iron filings saturated with urine, caulk the crack. This method has been tried on oil-pots on board whale ships with success.

6388. The Drummond Light. This brilliant light is produced by directing a stream of oxygen gas, passing through the flame of a spirit lamp, upon a small ball of quicklime of about ¼ inch in diameter. It gives an intense light; and, placed in the focus of a parabolic mirror, has been distinctly seen at a distance of 60 miles.

6389. Doebereiner's Self-Igniting Lamp. Take an ordinary fruit jar, with a cork stopper or leaden cover; procure any old bottle that will go into the jar, at least two thirds as tall as the jar. Cut off the bottom of the bottle either with a file or by wrapping a piece of candle-wick soaked in alcohol around it, burning the wick, and dipping in water while hot. (*See Nos.* 2367, *&c.*) A hole is cut in the cork or lead cover, to admit the neck of the bottle and prevent it resting on the bottom of the jar. The bottle is closed with a cork fitted with a short glass tube bent at right angles and drawn to a fine opening. Some pieces of zinc are suspended in the bottle by a wire or little basket of lead. The jar is then filled to about one-half with dilute sulphuric acid. The acid, coming in contact with the zinc, generates hydrogen gas, which escapes from the glass tube. The mixture of air and gas being highly explosive, the lamp should not be ignited until all the air has been expelled. After the air has escaped, a piece of spongy platinum may be placed a little distance from the point of the tube. The gas, impinging on the platinum, heats it sufficiently to ignite itself. The escape of gas may be cut off by slipping a rubber tube closed at one end over the glass tube, or a tube with a stop-cock may be used. As soon as the escape of gas is cut off, its pressure drives the acid out of the bottle into the jar, and no more gas is generated. Pieces of spongy platinum mounted on wires suitable for this use may be obtained of dealers in chemical apparatus. The lamp may also be purchased complete from the same parties.

6390. Pencils for Writing on Glass. Take 4 parts stearic acid, 3 parts mutton suet, and 2 parts wax; melt them together and add 6 parts red lead and 1 part purified carbonate of potassa, previously thoroughly triturated together. Set the mixture aside for an hour in a warm situation, stirring frequently, then pour it into glass tubes or hollow reeds.

6391. Elastic Cement. Dissolve 1 drachm gutta-percha in 1 ounce or more bisulphide of carbon, so as to make a fluid that will easily pass through coarse filtering paper. After filtering, add about 15 grains pure india-rubber, and let it dissolve; or, when it has become soft and gelatinous, quickly rub the whole smooth with a palette knife on a slab.

6392. To Mend a Balloon or Gas-Bag. Paint 4 or more coats of the varnish described in the last receipt, around the hole in the bag, allowing each coat to dry before the application of the next. Treat a piece of fine strong muslin in the same way. The last coat on each should be pretty thick, and, when nearly dry, apply the patch to the bag, and press evenly and quite firmly together. When at last the whole is dry, press with a warm iron, and then paint the surface of the new piece with a coat or two of the varnish. If nicely done, the bag will be as strong as ever. Chloroform may be used in place of the bisulphide of carbon.

6393. Improvement in Ink-Erasers. The Great Lightning Ink-Eraser may be used instead of a knife or scraper for erasing ink, in order to rectify a mistake or clean off a blot without injury to the paper, leaving the paper as clean and good to write upon as it was before the mistake or blot was made, and without injury to the printer's ink upon any printed form, or the ruling upon any first-class paper. Take of chloride of lime 1 pound, thoroughly pulverized, and 4 quarts soft water. The above must be thoroughly shaken when first put together. It is required to stand 24 hours to dissolve the chloride of lime; then strain through a cotton cloth; after which add a tea-spoonful of acetic acid (No. 8 commercial) to every ounce of the chloride of lime water. The eraser is used by reversing the pen-holder in the hand, dipping the end of the pen-holder into the fluid, and applying it, without rubbing, to the word, figure, or blot required to be erased. When the ink has disappeared, absorb the fluid with a blotter, and the paper is immediately ready to write upon again. Chloride of lime has before been used with acids for the purpose as above proposed; but in all previous processes the chloride of lime has been mixed with acids that burn and destroy the paper.

6394. To Preserve Clothes Pins. Clothes pins boiled a few moments and quickly dried, once or twice a month, become more flexible and durable. Clothes lines will last longer and keep in better order if occasionally treated in the same way.

6395. To Fasten Loose Window Sashes. The most convenient way to prevent loose window sashes from rattling unpleasantly when the wind blows is to make four one-sided buttons of wood, and screw them to the beading which is nailed to the casings of the window, making each button of proper length to press the side of the sash outwards when the end of the button is turned down horizontally. The buttons operate like a cam. By having them of the correct length to crowd the stiles of the sash outwards against the outer stop of the window frame, the sash will not only be held so firmly that it cannot rattle, but the crack which admitted dust and a current of cold air will be closed so tightly that no window strips will be required. The buttons should be placed about half way between the upper and lower end of each sash.

6396. To Detect a Counterfeit Bank of England Note. The Bank of England possesses no security which may not be known by any person who will make himself acquainted with the following characteristics of the paper, the plate printing and the type printing of the note. The paper is distinguished: By its peculiar color, such as is neither sold in the stores nor used for any other purpose. By its thinness and transparency, qualities which prevent any portion of the printing on the note being washed or scratched out without a hole being made. By its characteristic feel, which consists of a singular crispness and toughness, owing to the fact that the bank paper is made from new linen and cotton, not from rags. By the peculiar wire-mark or water-mark, which can only be produced when the paper is in a state of pulp; consequently the forger must procure a mould, and make his own paper, both requiring the skill of such first-rate artisans as are not likely to be met with in the haunts of crime. By the three deckle or rough edges. These edges are produced when the paper is in pulp; two notes being placed in the mould, and divided lengthways, hence the top and bottom, or *long* edges, are both rough. The deckle is the raw edge of the paper, and cannot be imitated by cutting. By the strength of the paper—a bank note will lift a hundred weight if carefully adjusted. The printing is of two kinds, type and plate; the paper is moistened by water driven through its pores by the pressure of the atmosphere; 30,000 double notes are thus moistened in the space of an hour. The ink used is made at the bank, from linseed oil and the charred husks and vines of Rhenish grapes; this gives a peculiar velvety black to the mark in the left-hand corner of the note. The notes are numbered by a machine which cannot err; and, lastly, are authorized by the signature of the clerk. The bank notes are printed on the side of the paper which receives the water mark, so that, if the paper be split, the unprinted surface only retains the slightest trace of that mark.

6397. To Flatten Engravings or Paper that has been Rolled Up. To succeed in this, take a roll of paper, wall-paper for instance, unroll a portion of it, and insert the paper or card-board, which is to be flattened, in such a manner that when the whole is rolled up again, the card-board will be bent the opposite way to which it was originally rolled. Roll up closely and evenly, and let it remain for about 15 minutes. If this be carefully done, the card-board will be flattened without danger of breaking, and free from the creases inevitably made if rolled backwards in the hands. If wall-paper be used, it should be as thick as can be obtained, and the larger the diameter of the roll, the better. Collectors of engravings will find it worth their while to obtain a straight roller, say 3 inches in diameter, and 5 or 6 yards of the stout paper sold in rolls or by the yard under the name of "pattern paper. The cost is trifling, and it will last for years.

6398. To Remove Water Stains from Engravings or Paper. Fill a sufficiently large clean vessel with pure water; dip the engraving in, waving it backward and forward until wet through. Then fasten it to a flat board with drawing pins, and let it dry in the sunshine.

6399. To Bleach Engravings, &c. Old engravings, wood cuts, and all kinds of printed matter, that have turned yellow, are completely restored by being immersed in this preparation for only one minute, without the least injury to the paper, if the precaution is taken to thoroughly wash the article in water containing a little hyposulphite of soda. Undyed linen and cotton goods of all kinds, however soiled or dirty, are rendered snowy white in a very short time by merely placing them in the liquid mentioned. For the preparation of Javelle water, take 4 pounds bicarbonate of soda, and 1 pound chloride of lime; put the soda into a kettle over the fire, add 1 gallon boiling water, let it boil from 10 to 15 minutes, then stir in the chloride of lime, avoiding lumps. When cold, the liquid can be kept in a jug ready for use. (*See No.* 4787.)

6400. To Clean Soiled Engravings. Lay the engraving, face downwards, in a perfectly clean vessel, sufficiently large to allow the engraving to lay flat; pour clean boiling water upon it, and allow it to stand until the water is cold; take it out carefully and remove as much of the moisture as possible with clean blotting paper, then place the engraving in a press between clean white paper. If very much soiled, a repetition of the operation may be necessary.

6401. Fine Black Hair Dye. This is composed of two different liquids, No. 1, called the *mordant*, which is employed to give permanency to the dye, and No. 2, which is the dye itself. Take ¼ ounce pyrogallic acid, 6 ounces alcohol, and 18 ounces water; shake them well together, and put the mixture in a glass-stoppered bottle. This is the *mordant*, and must be labeled *Solution No.* 1. To prepare the dye, take 1 ounce nitrate of silver, 2 ounces ammonia, and 8 ounces distilled water; dissolve in a stoppered bottle, and mark it *Solution No.* 2. This is a very fine article. (*See No.* 1201.) Directions for using the above dye may be found in No. 1202.

6402. Fire Kindlings. In France, a very convenient and economical kindling is made by dipping corn-cobs for about one minute in a bath composed of 60 parts melted resin and 40 parts tar. They are next spread out to dry on metallic plates heated to the temperature of boiling water. (*See No.* 6205.)

6403. To Convert Sized Paper into Blotting Paper. Common paper may be converted into blotting paper by immersing it for a few seconds in hydrochloric acid. Some recommend for this purpose a mixture of hydrochloric acid and water; but in experiments that have been made, the paper was immersed in a bath of the ordinary undiluted acid, removing it, after a few seconds, to a vessel in which it was treated to several changes of water.

6404. Rother's Soap Liniment. Take of soap (genuine castile, mottled or white), dry and in No. 12 powder, 24 troy ounces; camphor, 12 troy ounces; oil of rosemary, 3 fluid ounces; water, 3 pints; strong alcohol, 10½ pints. Mix the water with half a pint of the alcohol in a capacious vessel; add the soap and apply heat until solution has occurred; to this add 4 pints of alcohol. In the remaining 6 pints of alcohol dissolve the camphor and oil; to this add the solution of soap; mix. Let the impurities (coloring matter of the soap) subside, and filter. This is vastly superior to the officinal process. (*See No.* 4869.)

6405. Coating for Black-Boards. Incorporate flour-emery with shellac varnish, adding sufficient lampblack to give the required color. If too thick, reduce its consistency with alcohol. This varnish, applied to the surface of wood with a camel's hair varnish brush, produces an excellent black facing, and may also be used for preparing smaller writing tablets.

6406. Beautiful Black Ink. Take a sufficient quantity of elder berries, bruise and keep them for 3 days in an earthen vessel; then press out and filter the juice. To 12½ pints of the filtered juice, add ½ ounce each of sulphate of iron, and crude pyroligneous acid. The ink that results has, when first used, a violet color, but when dry is an indigo blue-black. In writing, it flows easily from the pen without gumming, and does not thicken as soon as common ink. These are no small advantages, and ought to recommend it for general use. (*See No.* 2460.)

6407. To Mount Prints. Make a thin size of fish glue or isinglass. Take a good sized flat varnish brush, wet the brush with the size just sufficiently to moisten the surface of the print to the extent of the width of the brush and the whole length of the print. Commence at one side and continue in this way until you have gone over the whole surface. Draw the brush with a light, quick stroke, as closely each time to the part previously wet as possible, without lapping or going twice in one place. When dry, go over it again in the same way, only at right angles to the first stroke. Let this dry, then proceed to mount as follows: Stretch, as tightly as it will bear, to a frame of the required size, a piece of new, smooth, fine muslin or factory cloth. Rub over the whole surface of this, with a good paste-brush, a sufficient quantity of well-cooked paste, made of equal parts of wheat-flour and starch, to thoroughly wet the cloth. Lay the print onto it, and, covering it with a piece of clean paper, rub it down both back and front, until smooth and fast. When thoroughly dry, varnish with white copal varnish.

6408. Varnish to Imitate Ground Glass. Dissolve 90 grains sandarac and 20 grains mastic in 2 ounces washed methylated ether, and add, in small quantities, sufficient benzine to make it dry with a suitable grain, too little making the varnish too transparent, and excess making it crapy. The quantity of benzine required depends upon its quality, from ½ ounce to 1½ ounces or even more; but the best results are got with a medium quality. It is important to use pure washed ether, free from spirit.

6409. Xylol, the New Remedy for Small-Pox. Xylol, xylene, or ethyl-benzine, as it has been respectively called, is one of the hydrocarbons formed from coal-tar naphtha. It was first procured by Hugo Müller, but its nitro-compound had previously been discovered by Warren De la Rue, in 1856. Coal-tar naphtha is submitted to fractional distillation until the part which boils at 141° is separated; this is submitted to the action of fuming sulphuric acid, which dissolves the xylol and leaves the other hydrocarbons. The xylol is then separated by distillation from this mixture. Xylol is said to have been used by Dr. Zuelzer, the Senior Physician at the Charité Hospital at Berlin, with great success in cases of small-pox. The theory of its action would appear to be that xylol is taken up by the blood, and acts as a disinfectant. Its boiling point is variously stated at 139° to 140°. The specimens examined by the writer generally commenced to boil at about 135°. The specific gravity was .866. It is said that the purity of xylol is of importance, but there is no very ready method for testing its purity. It should be soluble in fuming sulphuric acid, but it is not soluble in the ordinary sulphuric acid of the Pharmacopœia. It has a faint odor something like benzole, and an aromatic taste. The doses are 3 to 5 drops for children; 10 to 15 drops for adults, every hour to every 3 hours. It is quite harmless in reasonable doses. In Berlin it is given in capsules. As it is very insoluble, the best method of giving it would be in an emulsion of almonds. (*Tichborne.*)

6410. To Examine Wells or Chimneys. In case the bottom of a well needs examining, hold a mirror in such a position as to reflect the sun's rays in the water, so that anything floating on the surface can then be plainly seen. If the contents of the well are not turbid, the smallest object on the bottom can also be distinguished. In this way objects dropped in wells of 60 feet in depth, and which contained more than 20 feet of water, have been traced and recovered. When the objects are small, or a minute examination of the bottom is required, an opera-glass may be used. If the top of the well is not exposed to sunlight, a mirror may be placed outside, even at a great distance, to reflect the light over its top, where a second mirror may reflect it downward. Letting a lamp, candle, or lantern down gives by no means as successful a result, as the light is very weak compared with sunlight, and its glare, even when the eyes are shaded from its direct rays, prevents distinct vision. The method of employing two mirrors, one outside reflecting the solar rays in a room, and a second small mirror in its path to reflect these rays into a dark cavity, is employed by physicians, for the examination of cavities of the body; for instance, to explore the tympanum in the human ear, the throat, etc. To examine a straight chimney a piece of looking-glass is to be held, inclined at an angle of 45°, in the hole in the chimney wall, into which the stove-pipe is to go, or in the open fireplace. If the observer can see the light of the sky, he will also see the whole interior of the chimney, and any obstruction in the same. As most chimneys are straight, the top will be clearly visible.

6411. To Clean Furniture. Mix together 1 pint cold drawn linseed oil, 1 pint best vinegar, and ½ pint spirits of wine. Dip a soft cloth into the mixture and rub over the furniture, and then wipe thoroughly with a clean soft cloth. Always shake the mixture before using. We do not know any article for cleaning furniture equal to this. (*Trent.*)

6412. To Wash Ladies' Summer Suits. Summer suits are nearly all made of white or buff linen, piqué, cambric or muslin, and the art of preserving the new appearance after washing is a matter of the greatest importance. In the first place, the water should be tepid, the soap should not be allowed to touch the fabric; it should be washed and rinsed quickly, turned upon the wrong side, and hung in the shade to dry, and when starched (in thin-boiled, but not boiling starch) should be folded in sheets or towels, and ironed upon the wrong side, as soon as possible. Linen should be washed in water in which hay or a quart-bag of bran has been boiled. This last will be found to answer for starch as well, and is excellent for print dresses of all kinds; a handful of salt is also very useful to set the colors of light cambrics and dotted lawns; and a little beef's gall will not only set, but brighten, yellow and purple tints, and has a good effect upon green. No soda, or other washing compound should on any account be used.

6413. To Dissolve Wool Out of Mixed Fabrics. Boil the rags in a mixture of 1 part nitric acid and 10 water, or a little stronger. The cotton fibre, after drying, can be shaken out as dust in a willowing machine, leaving the wool behind ready for dyeing. This is the plan adopted in England and Germany for making "extract," and is used for mixing with wool in many manufactures. This prepared wool, however, will be found to have lost, to a great extent, its felting property.

6414. Javelle Water. Many persons keep on hand a supply of Javelle water, small quantities of which are sufficient to render the most soiled linen perfectly white. It is prepared by taking 4 pounds sal-soda to 1 pound chloride of lime in 1 gallon water. Put the sal-soda into a vessel over the fire, add 1 gallon boiling water; let it boil for 10 or 15 minutes, then add the chloride of lime by throwing it, free from lumps, into the soda water. When cold, pour into a jug or large bottle and cork tightly. Where it is desirable to have a larger quantity, the following mixture can be taken: Stir 5 pounds chloride of lime into 2 pails warm water; dissolve 10 pounds glauber salt (sulphate of soda) in 1 pail water; also 4 pounds sal-soda in 1 pail water. The contents of the 4 pails can be poured together and kept in any suitable tight vessel. Such a quantity as the above ought to last a long time, as a dipperful of it would bleach a large quantity of linen or other goods. The materials are cheap, and the mixture easily made. (*See No.* 4787.)

6415. To Detect Blood-stains. It is said by Professor Bloxam, of London, that a mixture of tincture of guaiacum and a solution of peroxide of hydrogen in ether produces instantly, with blood or blood stains, a beautiful tint of blue. He had taken a single lint fibre, on which was a stain of blood scarcely perceptible, that had been made twenty years before, and he found that the test produced immediately the characteristic blue color, which was easily detected on a microscopic examination. (*See No.* 4393.)

6416. Artificial Honey. Put 10 pounds white sugar in 2 quarts water, and gradually heat it, stirring it occasionally until brought to the boiling point. Then remove from the fire and add 1 pound real honey. When half cooled, add ½ pound more honey, and, when only blood warm, add another ½ pound honey. When nearly cold, add 10 drops good essence of peppermint. This makes 16 pounds in all of a very good sweetening. Its flavor can be varied to the liking by adding more or less peppermint essence. (*See Nos.* 1572, *&c.*)

6417. Grape Champagne. Gather the grapes when they are just turning, or about half ripe; pound them in a tub, and to every quart of pounded fruit add 2 quarts water. Let it stand in the mash-tub for 14 days, then draw it off, and to every gallon of liquor add 3 pounds loaf sugar. When the sugar is dissolved, cask it; and, after it has done working, bring it down. In 6 months it should be bottled, and the corks tied down or wired. This produces a domestic real champagne, in no way inferior to the genuine imported article.

6418. Imitation White Frontignac Wine. Boil 18 pounds white powdered sugar, with 6 gallons water, and the whites of 2 eggs well beaten; then skim it, and put in ¼ peck elder flower from the tree that bears white berries; do not keep them on the fire. When nearly cold, stir it, and put in 6 spoonfuls lemon juice, 4 or 5 of yeast, and beat well into the liquor; stir it every day; put 6 pounds best raisins, stoned, into the cask, and tun the wine. Stop it close, and bottle in 6 months. When well kept, this wine is an excellent imitation of Frontignac.

6419. Imitation Red Frontignac Wine. This is made in the same manner, and with the same ingredients as the white wine (*see No.* 6418), except that dark elderberries are used instead of white.

6420. Cure for Fever and Ague and Intermittent Fever. Take 40 grains sulphate of quinine, 30 grains powdered liquorice, and 10 grains gum myrrh. Make into 40 pills. Take 2 pills every 2 hours for the first 24 hours; 2 pills every 4 hours for the second 24 hours; and the remainder, 1 at night on going to bed, and 1 in the morning, first thing. This performs an effectual cure if the directions are *implicitly* followed. (*Trent.*)

6421. To Remove Tar or Pitch from the Skin. Mix together pulverized extract of liquorice, and oil of aniseed to the consistency of thick cream; rub it on the part thoroughly with the hand, then wash off with soap and warm soft water.

6422. To Remove Tar, &c., from Glass. It is not easy to remove tar, pitch, Venice turpentine, and other sticky substances from the graduated glasses used for measuring them. A mixture formed of the same ingredients as in the last receipt, combines with the sticky matter so completely as to allow of the whole being rubbed off dry and clean with a piece of cotton.

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INDEX.

In the compilation of this Index, especial pains have been taken to economize space as much as possible, without impairing its usefulness for ready reference. With this end in view, classification of items has been largely resorted to; so that, in many cases, a single entry will embrace several receipts, varying in number from two or three to twenty or more.

Some discretion is, therefore, advisable in searching the Index for any desired receipt. If, for instance, it is required to find out "How to put out a fire in a Chimney," it will naturally be found under "Chimney," the object to be operated upon. Again: in searching for some preparation of a compound body, "Solution of Citrate of Magnesia," for instance, it would be found under "Citrate of Magnesia," the principal ingredient, and not under "Magnesia," which, although its base, is an entirely different substance.

Proprietary preparations and processes will be found only under the name of the inventors; thus, "Brandreth's Pills" are indexed under "Brandreth," and not under the head of "Pills;" this latter heading including only such as have no such distinctive designation. This is done to avoid needless repetition, and thereby save space.

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how to mount small insects under a microscope, how to remove stains from black crape or mourning dresses, and how to polish alabaster.

Perusing these pages will afford hours of pleasure to old and young alike, as either a nostalgic look into another era or as a sort of "Whole Earth" catalog of the 1870's.

Leicester and Harriet Handsfield moved from New York City to a pre-Revolutionary War home in northwestern Connecticut in 1972. In the course of doing some refinishing they wanted to know about milk paint, often used as a coating on furniture. A copy of Dick's Encyclopedia that had belonged to Leieester's grandfather was unearthed and consulted. The Handsfields not only learned all about milk paint, but became so engrossed in the book that they spent hours poring over it. They are confident that others will find it equally good reading.

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